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# TRAWL GEARS OPERATED BY EFP

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EXPLORATORY FISHERIES PROJECT

GOVERNMENT OF INDIA

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# TRAWL GEARS OPERATED BY EFP

FISH TECHNOLOGY EXPERIMENT STATION
C.F.T.R.I.
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CONTENTS

# PREFACE

Fisheries Technology forms a very major part of the subject Fisheries Science, which encompasses the total system of work of investigating, locating and taking a catch, processing, storing and transporting, to the sale of products to the consumers. Fisheries naval architecture and engineering and fishing gear technology combine to form Fisheries Technology. The area of Fisheries Science that has contributed to the maximum to the astounding increase in the productivity of fishing operation is fishing gear technology. As elsewhere in the world, this is true in the development of marine fisheries in India too. Exploratory Fisheries Project, formerly known as the Deep Sea Fishing Organisation, has the unique distinction of inducting 'bottom trawl gear' as the most successful fishing gear and bottom trawling as the most effective fishing method in this country since independence. The combination of this system revolutionized the prawn fisheries. Exploratory Fisheries Project have operated a large range of size and design of bottom trawl gears, for shrimp and fish over the years. Efforts are made, through this publication, to make available the data concerning these gears to the end users. It is likely that the presentation of various data concerning the gears is not complete. But if the information furnished becomes useful in some manner, it would have achieved one of the aims of this publication.

M. SWAMINATH
DIRECTOR

# A C K N O W L E D G E M E N T S

The authors acknowledge the keen interest evinced by Shri R.K.Saxena, Joint Secretary(Fisheries) and Dr.T.A.Mammen, Joint Commissioner(Fisheries) in extending timely assistance to the Project for equipping it with me and material for effectively discharging its duties.

The authors also acknowledge the cooperation extended by the officers-in-charge and the Technical Assistants of various bases of Exploratory Fisheries Project in furnishing basic information, without which this compilation could not have been brought out. They also wish to place on record their thanks to Sarvashri R.K.Khavnekar, Draughtsman, R.Selvaraj, Artist, A.K.Bhattacharya, Projector operator and S.B.Sawant and K.J.Jadhav, offset machine operators of the Extension wing, for their team work in preparation and printing of the publication. Thanks are also due to Shri G.V.S.R.Murthy and Kumari Pushpa G.Lulla for their secretarial assistance.

## 1. INTRODUCTION

Demersal trawling continues to be one of the most important fishing methods of the world and therefore bottom trawl net takes a primary place among all fishing gears in use in sea fisheries of many countries. In India otter trawl fishing was first introduced in the latter half of 1940's by Exploratory Fisheries Project, the erstwhile Deep Sea Fishing Organisation.

It has taken many decades of established trawl net design, rigging practices and operational procedures for the otter trawl to reach its present state of development. Over the years technology has developed, principles of hydrodynamics and theories of engineering have been applied in the field. fish behaviour and its interaction with the gear have been extensively studied, strong and refined materials have come to use and efficient practices and procedures have been evolved. Incorporation of these blessings improved the status and standard of gear technology.

In India the size and design of trawlers are changing, improving their capability to reach far away fishing grounds and to catch fish from those grounds that were not attempted hitherto. EFP being the pioneering agency of Govt. of India in the field of industrial fishing, it is our privilege to make available to the industry the various particulars of trawls operated from the different size and type of vessels of the EFP fleet. A publication describing the particulars of construction of different types of fishing gears would be very useful to the fishing vessel operators to gain information on the fishing gear materials and design characteristics and to select suitable fishing gear.

## 2. EVOLUTION OF TRAWL GEARS

Man from the very beginning of his history had a lust for fish and he developed various devices for catching fish. The first implements, probably used by man some 25,000 years ago were clubs, spears, harpoons, bows and arrows. In his quest for fish, man tried to improve these extremely primitive methods and in course of time, advanced types of gears came into existence.

Among the fishing nets, one of the earliest form used was a stow net which was fixed by two poles driven into the sea bottom and two horizontal poles tied to the net to form the mouth. This method, being entirely at the mercy of the current, was a passive one, and the escapement of fish was very much. The search for a more effective method to improve the efficiency of fish catching ultimately caused the use of drag net. Net in the form of bag with a proper mouth and wings on either side to guide the fish, when towed along the sea bottom was found very effective in catching demersal fishes. With the availability of steam and motor power the fishing operations were extended from inshore areas to offshore areas and bigger size nets were used. The consequent enlargement of mouth frame structure made the operation of net more cumbersome and therefore the rigid frame was replaced by a simpler construction consisting of one horizontal beam secured at each side on top of the iron shoe provided. Fishing with this beam trawl, which is often referred to as the forerunner of modern deep-sea trawl gear, was the principal method of harvesting demersal

fishes in use till the turn of last century and still in use in North Sea and Baltic for fishing crabs, shrimps and soles.

Though introduction of beam trawl was a tremendous advancement in man's strive to devise improved types of fishing gear, the relatively slight strength of the beam and difficulty in handling precluded any suggestion of increase in its length and further enlargement of the trawl became impossible. .Moreover, the vertical opening of the trawl also was very limited confined to a few feet only. It was then necessary to abandon the rigid framing of the trawl mouth and replace it by a non-rigid device. Attempts continued in this direction with the expansion of knowledge experience in gear technology, otter trawls were introduced in 1880's in which a pair of boards achieved the horizontal opening and buoyant devices on head line and sinkers on ground rope maintained the vertical opening.

Having established this basic pattern, the next attempt was directed towards improving the design of the net and accessories so as to catch the maximum quantity of fish per unit effort. The introduction of Vigneron Dahl gear during 1920's was the most major step in this line. Addition of bigger size vessels to the fishing fleet in many countries demanded nets of larger dimensions and then emerged the modified Vigneron Dahl gears and subsequently the enlarged Granton trawl pattern.

These Granton trawl nets or their modified versions continue to be widely used in almost all countries in the world fisheries. The need for developing trawl net patterns different from the conventional designs suiting the local conditions was felt and different new designs were evolved in various countries of which the high opening type of Russia, the four-seam pattern of Japan, the Atlantic Western trawl of Canada and the semi-bottom type of Mexico became very popular. Contribution of North West European countries in this field has been quite substantial.

Though the last two centuries witnessed phenominal development in trawl gear practices, the initial stages have been based simply on common sense and visual observations. These did not exist an intelligent communication system between the gear technologists and fishermen due to which the long term experience of practical fishermen could not be theoretically generalised and scientifically modified. But the last three to four decades have been the introduction of engineering theories and application of hydrodynamic principles coupled with systematic testing of gear to determine the factors which influence the size of catch. Studies embracing the whole complexicity of hydro-dynamic behaviour of trawl boards, the net, floats and other accessories were undertaken in many test houses in different parts of the world. During the last few decades, research and development of trawl gears have assumed greater importance in India and integration of the technological approach to the actual field have given rise to diverse patterns and designs of trawl gear suited for operation in the Indian waters.

## 3. MAIN PARTS OF A TRAWL NET

The different parts of a trawl net as illustrated in Fig.1 can be grouped under two main heads viz. (1) Webbings and (2) Lines and ropes.

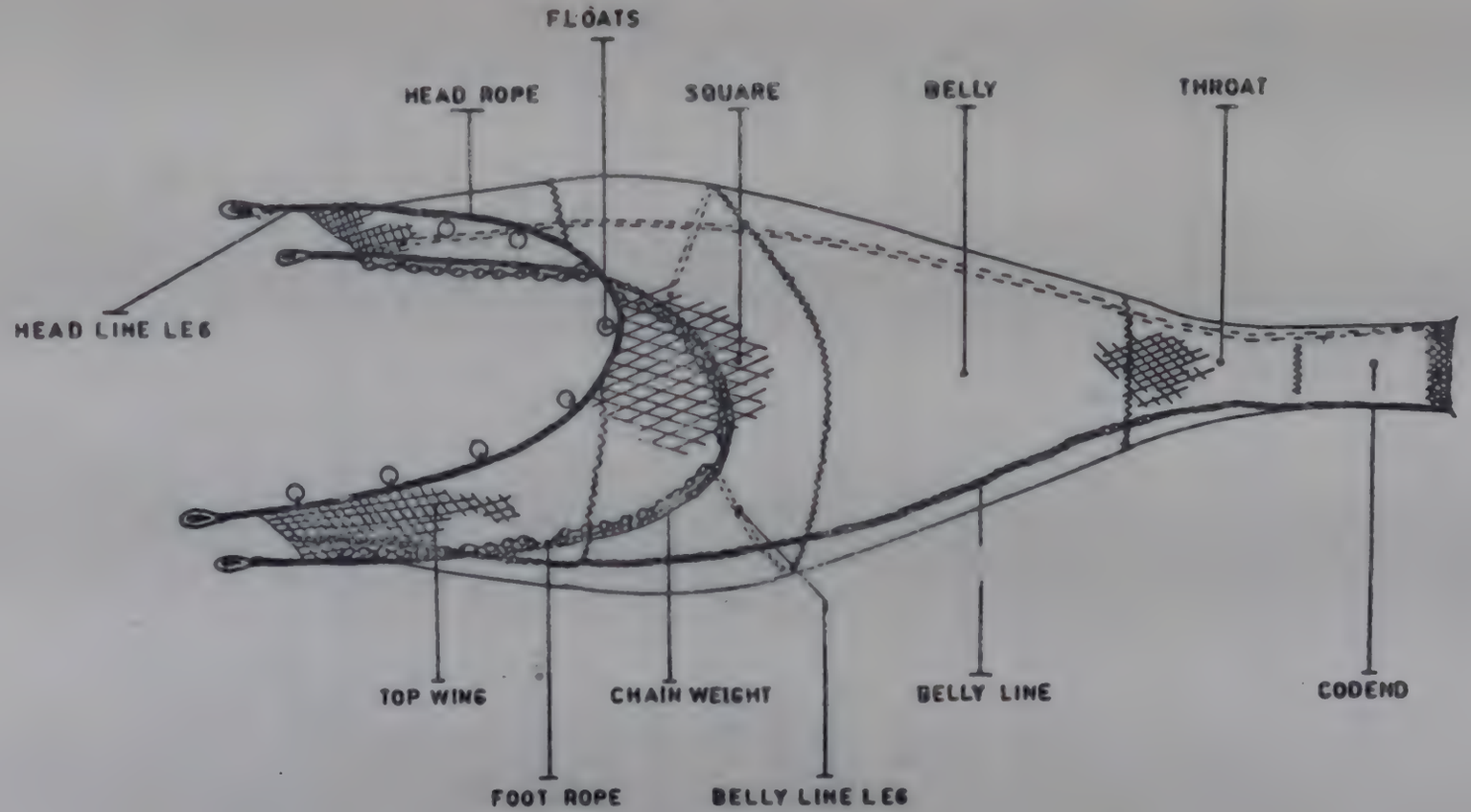
### 3.1. Webbings

**Square** is the front portion of the upper section of a trawl which is fitted between the body and the two upper wings so that it partially overhangs the lower part of the net. The square or overhang panel extends from the upper belly to the head rope.

**Wings** are the forward extension of webbings on either side forming major part of trawl mouth for guiding the fish towards the bag of net. They are in pairs, one on either side. The upper wings are attached on either sides of square piece and the lower wings on either sides of lower belly. The head rope is attached from one top wing and across the centre part of the square and along the opposite top wing to the end. Rigging of foot rope to the lower wing also is similar except that the square attached is replaced by the lower belly.

**Bosom** is the centre portion of trawl between the wings on upper and lower sections.

# FIG. 1. SECTIONS OF A TWO SEAM TRAWL



Jibs are the triangular pieces of webbing attached on either sides of the upper and lower bellies at their junction with wings to present a smooth shaping to the mouth of the net. These are made in pairs, one for each side. The four seam type of trawls are invariably provided with jibs.

Quarters are the two junctions where the top wings join the square.

Side panels are two identical pieces of webbing attached on either sides of the belly to join the upper and lower portion of a four seam trawl. The portion of the webbing, that comes above the belly is termed 'top wedge' and the portion placed adjacent to belly is known as 'lower wedge' or 'side wedge'

Bellies: The bellies, uppoer and lower, form the channel of trawl through which fish moves to the codend. Upper belly is the portion of webbing between the square and throat (or codend) on the upper side of a trawl. It is also called 'top body' or 'baiting'. Lower belly is the section of webbing that forms the lower body of the trawl from the foot rope to the fore-part of the throat or codend.

**Throat** is the portion of webbing placed in between or intermediate to the belly and codend. It is also known as 'lengthener' or 'extension piece'.

**Codend** is the narrow rectangular end section of the trawl net usually of heavy construction with small meshes where fish is collected during the operation of the net. One edge is joined to the end of the belly or the lengthener and the other end is laced to a thick rope which in turn is secured to a wire rope. A cod line is heaved through for joining two sections into a bag on releasing of which the catch will be unloaded on board.

**Flapper** is the small trapezoidal piece of netting whose wide front edge is laced in the fore-part of the codend to the upper panel, the sides to the lower panel, while the short rear edge remains free and forms the mouth of the codend. It acts as a safety device to prevent the escape of fish from the codend. Floppa, pocket, valve, trap etc. are some other names used for the flapper. In nets where longthers are provided flapper is very seldom used.

**Apron:** Otherwise known as Hula skirt is an

old piece of thick netting attached around the codend as a chafing gear. It is fitted purely as a protection against wear and should not be attached in any way so that it prevents the escape of small and immature fish.

3.2. Lines and ropes

Head rope is the rope or line forming the upper lip of the trawl to which the upper edge of net is finally attached. Eye splices, usually reinforced by thimbles and provided at both the ends of headline and floats are attached to this rope for keeping the net buoyant.

Foot rope: This rope otherwise known as ground rope is the one to which the lower edge of the net is finally attached. Splices are provided as in head rope and weights are attached to this rope for stretching the net downwards.

Bolch line: is a line or thin rope to which the webbing is initially hung, prior to the rigging of the net to head rope and foot rope

Belly line: Belly of trawl net is a vulnerable spot and required reinforcement. Belly lines are the strengthening ropes seized along the joinings where the upper and lower panels are laced together or laced with the side panels.

Belly line legs are two in number, usually provided in two seam trawls, run from the quarter mesh at foot rope along a halfer to the other end of bosom where they join the belly line. They help to bear the lateral strain on the trawl when it is being towed and hauled up.

## 4. SOME IMPORTANT DETAILS OF CONSTRUCTION

### 4.1. Bating and creasing

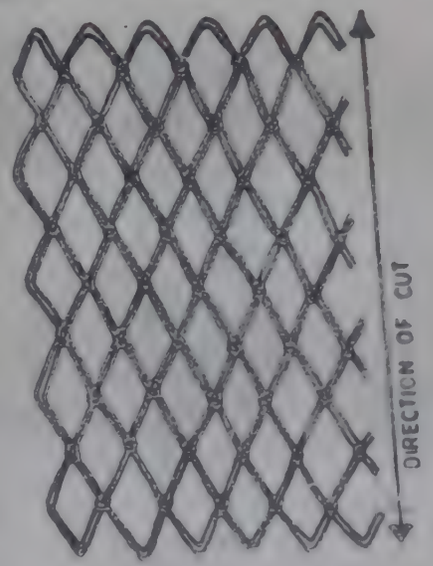
The shape of the pieces of netting of which a gear consists is achieved by reducing or increasing the number of meshes in width or length. While preparing webbings by hand braiding, the required taper is effected by increasing or decreasing the number of meshes in the concerned rows. But at present large scale manufacture of nets is undertaken which is considerably economical than hand braiding and in such instances ready made webbings are tailored into panels of required size and shape. The cutting of webbing should be done with minimum possible wastage and for this a clear understanding of the process involved becomes essential. Bating is the term generally applied for the process of cutting to obtain the desired tapering panel from the hand made or machine made webbing.

Basically there are three cutting patterns (Fig.2 a).

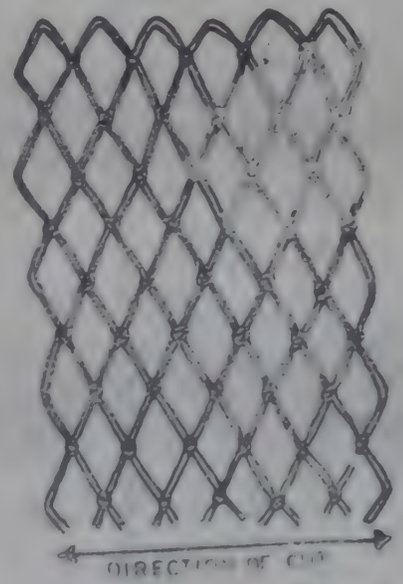
'All points' or the 'normal' cut where the cut is perpendicular to the general course of the yarn in knotted netting. This method also known as square cutting or mirror cutting will give rectangular or square pieces of webbing.

'All Bars' where the cut is parellel to a line of sequential mesh bars. Here the webbing is cut diagonally by cutting only one leg from each knot and a right angled triangular piece will be obtained where the two sides are equal. This method is sometimes referred to as

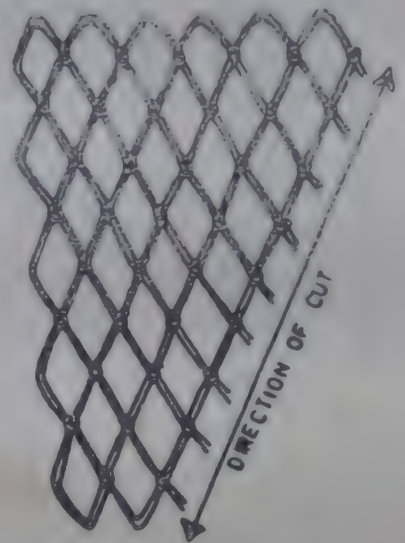
FIG. 2 a. THE BASIC CUTTING PATTERNS




ALL POINT OR NORMAL CUT

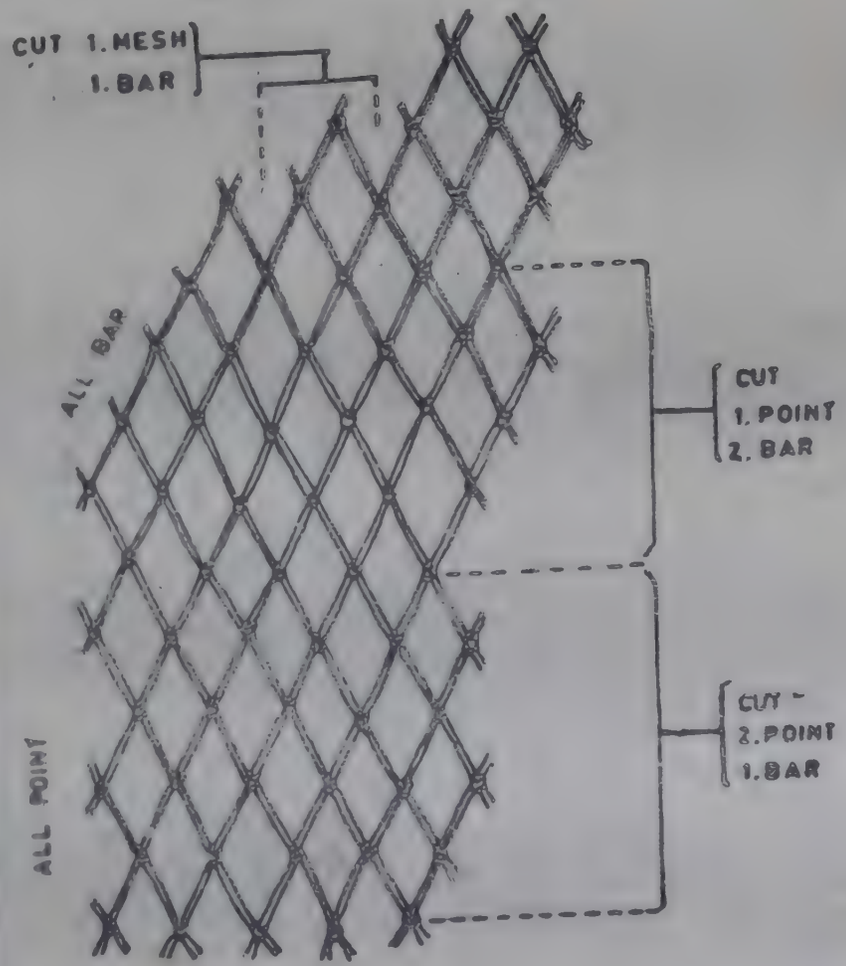



ALL MESH OR TRANSVERSAL CUT




ALL BAR OR DIAGONAL CUT

FIG. 2b. A COMBINATION OF DIFFERENT CUTTING PATTERNS




ALL MESH

'Cutting by cross lines'

'All meshes' or the 'transversal' cut where the cut is parallel to the general direction of the yarn in knotted netting.

The other cutting patterns are combinations of these three basic patterns, calculated according to the requirements (Fig. 2 b). If the taper required is less rapid than 'all bar', then 'point and bar' is used, if more rapid then 'mesh and bar' cutting is used.

Point and bar cutting: When this pattern is adopted half a mesh is lost every time a bar is cut and the cut webbing becomes one row longer, while every time a point is cut webbing becomes two rows longer.

Mesh and bar cutting: Half a mesh is lost every time a bar is cut and the cut webbing becomes one row longer, whereas cutting a mesh does not increase the length of the cut webbing. The cutting rate or the taper ratio gives the systematical combination of different types of cuts. A netting panel is shown in Fig. 2 b in which different cutting patterns and their combinations are illustrated. A few principal cuts are listed below showing the degree of tapering gained/lost (Garner, 1962).

| | Cut | Loss/Gain |
|---|---|---|
| A | All bars | 1 mesh in 2 rows |
| B | 1 pt. 4 bars | 1 mesh in 3 rows |
| C | 1 pt. 2 bars | 1 mesh in 4 rows |
| D | 1 pt. 1 bar x 2<br>1 pt. 2 bars | 1 mesh in 5 rows |

| | Cut | Loss/Gain |
|---|---|---|
| E | 1 pt. 1 bar | 1 mesh in 6 rows |
| F | 1 pt. 1 bar x 3<br>2 pts. 1 bar | 1 mesh in 7 rows |
| G | 1 pt. 1 bar x<br>2 pts. 1 bar | 1 mesh in 8 rows |
| H | 2 pts. 1 bar x 3<br>1 pt. 1 bar | 1 mesh in 9 rows |
| I | 2 pts. 1 bar | 1 mesh in 10 rows |
| J | 3 pts. 1 bar<br>2 pts. 1 bar | 1 mesh in 12 rows |
| K | 5 pts. 1 bar<br>6 pts. 1 bar | 1 mesh in 24 rows |
| L | All pts | None |
| M | 1 mesh 1 bar | 1 mesh in 3 mesh |
| N | 1 mesh 2 bars | 1 mesh in 2 mesh |

A ready reckoner is furnished in Appendix 16 in which the number of meshes lost or gained with reference to the depth of webbing in respect of the common cutting rates are given. Again, there is a general formula to arrive at the baiting ratio which is illustrated below:

From a rectangular webbing ABCD, a triangular panel CDE is to be cut. Applying the formula $\frac{P}{B} = \frac{(L-N)}{2N}$

FIG 3a. BAITING METHODS

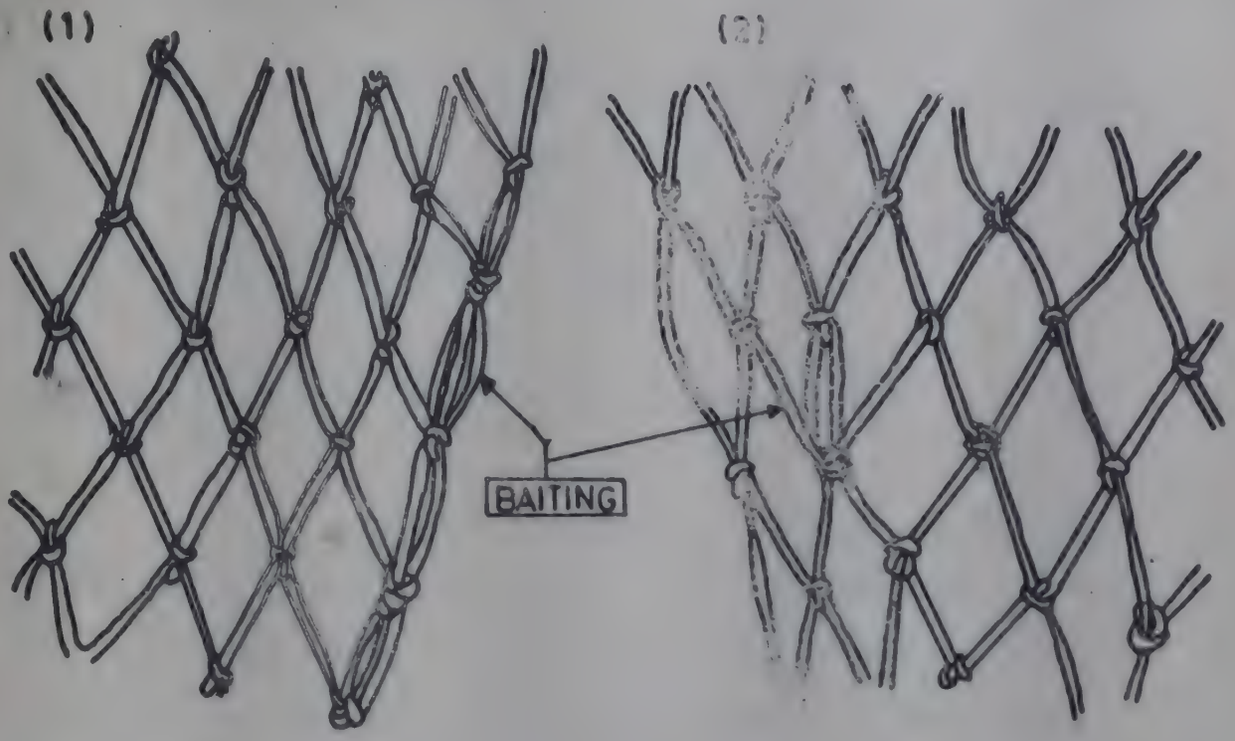
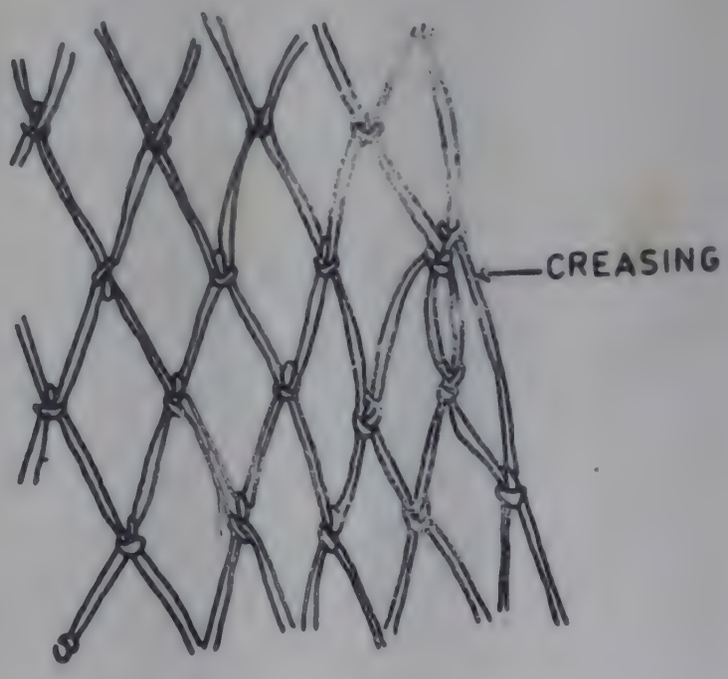



FIG 3b METHOD OF CREASING



Where P = Point

B = Bar

L = Number of meshes in length of the required panel and

N = Number of meshes in height of the panel

We get $\frac{P}{B} = \frac{(100-60)}{2\times60} = \frac{40}{120} = \frac{1}{3}$

i.e. 1P 3 B is the cutting ratio to be applied.

In hand braiding the effect of bating can be achieved in two ways. One method, called flat baiting involves doubling the twine at the end of a row so as to cut out one mesh instead of making the mesh (fig. 3 a (i)). The desired degree of tapering can be achieved by making the cutting steps at calculated intervals. Another method of reducing is to pull two meshes together when forming the next mesh below them (fig. 3 a (ii)). This may be done at the ends or in the body of the net, but the latter is not advised unless a quicker taper than is possible by working at the ends is needed, as the net will be distorted.

Fishing net designs often require the number of meshes in a panel to increase and this is termed creasing. It is done by forming false meshes as shown in fig. 3 b. Here again it is advisable to do it at near the end of a row to minimise distortion.

4.2. Joining of panels and take up ratio

Once the panels as per requirements are ready for a fishing net, the next step in fabrication is joining of the nettings. It is the process of connecting by means of a thread, the edge of netting panels which may differ in number of meshes, mesh size and type of cut. There are many variables while joining, but it is fairly standard practice to join together two sections with double twine or single twine of different colour and greater strength. This in addition to serving as a marker will halt ripping from one section of net to the next. The common methods of joining employed in fabrication of trawl nets are illustrated:

1. Sewing:

Sewing is the process where the connecting yarn makes a knot at every mesh it passes through and in course half a mesh is formed in between the two joining edges. Some methods of sewing are furnished below:-

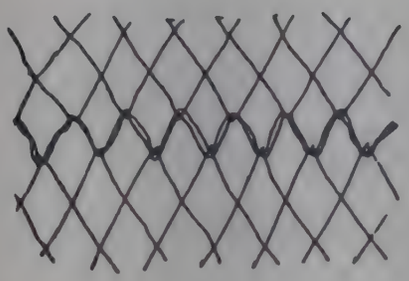
a) Joining of panels with same number of meshes having same (fig. 4 a) or different mesh sizes (fig. 4 b).

b) Joining of panels with different number of meshes and either same or different mesh sizes (fig. 4 c).

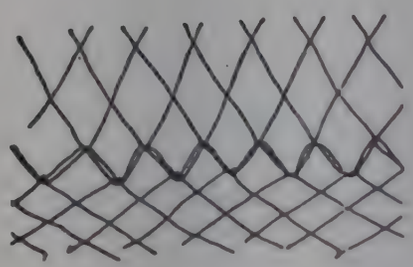
FIG. 4. METHODS OF JOINING NETTING PANELS

SEWING

(a)

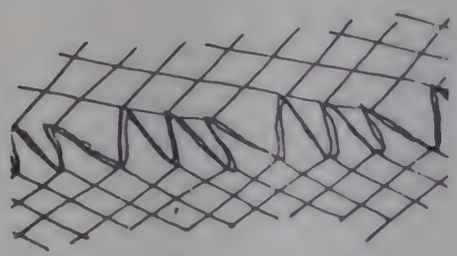


(b)



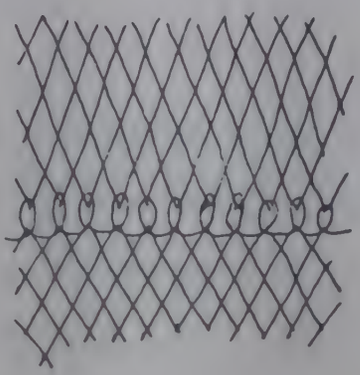
(c)

(d)

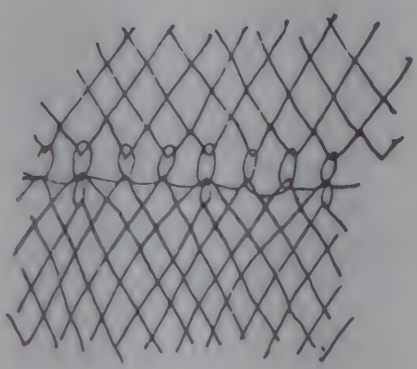


LACING

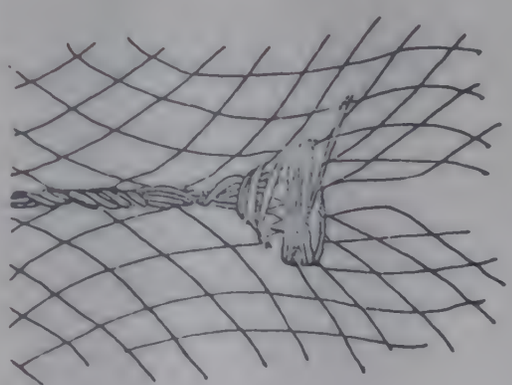
(e)



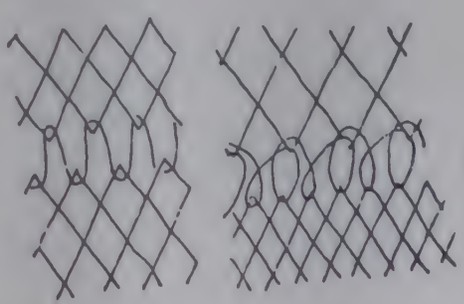
(f)



(g)



(h)



c) Joining of panels where the edges are cut differently (fig. 4 d).

2. Lacing (Seaming)

Knots are not necessarily made at every mesh and no new mesh or part of mesh is formed in the process of lacing. Some commonly adopted methods are illustrated:

a) Joining of panels with same number of meshes and either same or different mesh size (fig. 4 e ).

b) Joining of panels with different number of meshes and either same or different mesh sizes (Fig. 4 f)

c) Joining of panels with same number of meshes and same mesh size or with different number of meshes and different mesh sizes (Fig. 4 g).

d) Joining of panels with same number of meshes or different number of meshes with different types of cut (Fig. 4 h).

4.3. Take up (joining ratio)

For joining of different panels, the proportion of the number of meshes on one panel's edge to the number on the other panel's edge is indicated as a fraction or ratio. For eg.

$\frac{A}{B} = \frac{3}{4}$ or A:B = 3:4 refers

Three meshes of panel A to be joined with 4 meshes of panel B. Another way of expressing joining ratio is to refer to the extent of length of each panel, instead of the number of meshes. For e.g. $\frac{A}{B} = \frac{3\ m}{4\ m}$ indicates that, each time, 3 m of panel A to be joined with 4 m of panel B.

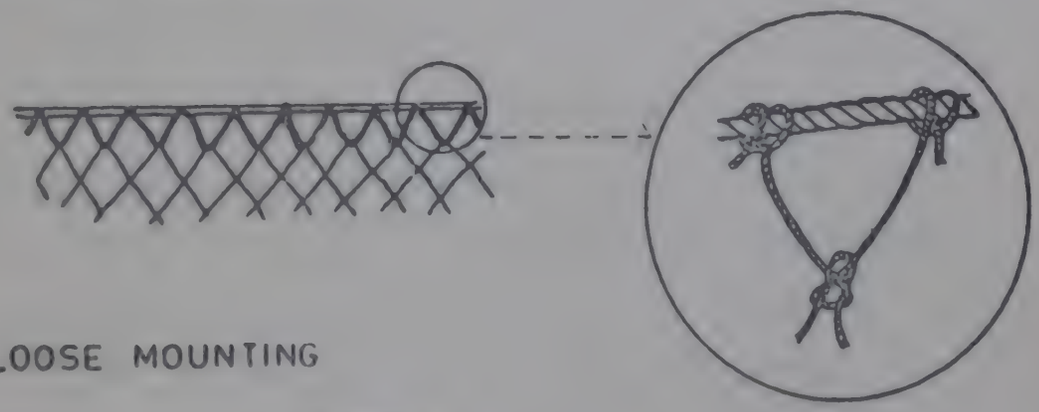
4.4. Mounting of nettings and "Hanging coefficient"

Once the netting panels are joined together the webbing must be affixed to some kind of line or rope along its mouth edge. This is described as hanging or mounting of the net. The line or rope to which the webbing is first hung before attaching to the head rope or foot rope is known as bolch line and the mounting yarn is referred as stable line. The following are some of the methods used for mounting the webbing in trawl nets.

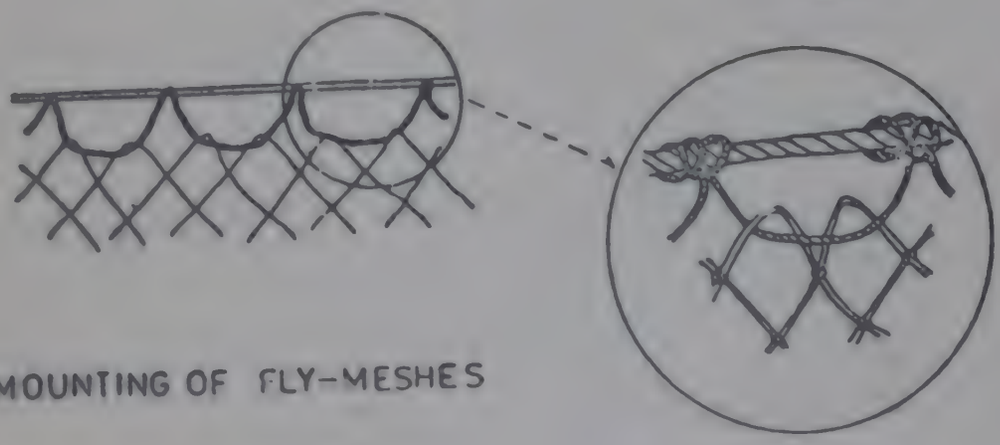
1. Direct mounting or fixed mounting where each mesh is fixed directly on to the rope by means of a mounting yarn (Fig. 5 a).

FIG. 5. SOME MOUNTING METHODS

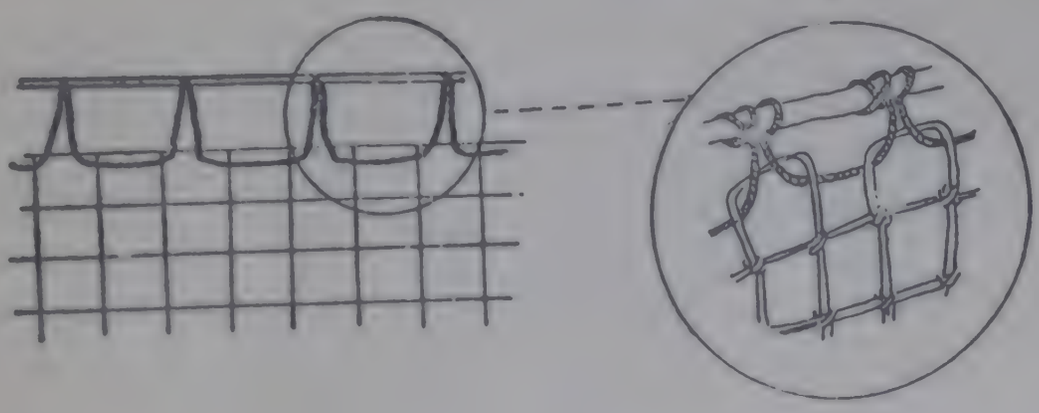
(a) DIRECT MOUNTING



(b) LOOSE MOUNTING



(c) MOUNTING OF FLY-MESHES



2. Loose mounting where the meshes are hung freely on to the mounting yarn and the mounting yarn is fixed to the rope at definite intervals (fig. 5 b).

3. Mounting of fly meshes is done by securing each mesh loosely to the rope by means of a mounting yarn tied to the rope (Fig. 5 c).

The correct hanging of the webbing to the bolch line is a very important factor to get the definite degree of opening to the meshes. Variation from the desired ratio will cause strain and stress on the webbings and will result in malfunctioning as well as quick distortion of the gear. The hanging coefficient for e.g. when expressed as $\frac{a1}{A} = \frac{4}{5}$ or $\frac{a1}{A} = 0.8$ refers 5 m length of webbing A to be mounted on 4 m rope (a 1). In other words 1 m webbing to be mounted on 0.8 met rope.

On completing the hanging of webbing the last step left in fabrication of a trawl gear is fixing of the net to the supporting ropes. This is done by securing the upper bolch line to the head rope and lower bolch line to the foot rope by means of sittings as illustrated in fig. 6.

## 5. ABBREVIATIONS AND SYMBOLS USED

| | |
|---|---|
| A B | : All Bar cut |
| Al | : Aluminium |
| B | : Bar cut |
| G.I. | : Galvanised Iron |
| G.R.T. | : Gross Registered Tonnage |
| G.S.W.R. | : Galvanised Steel Wire Rope |
| H.P. | : Horse Power |
| Kg | : Kilogram |
| Kgf | : Kilogram force |
| m | : meter/mesh (to be recognised from context) |
| mm | : Millimeter |
| N | : Normal cut |
| OAL | : Overall length |
| PE | : Polyethylene |
| Pl | : Plastic |
| PP | : Polypropylene |
| ⌀ | : Diameter |
| | : Single braided |
| | : Double braided |
| | : Upper Panel |
| | : Lower panel |

## 6. GEAR CATALOGUE LIST

| Sl.No. | Name of Gear | Fig. No. |
|---|---|---|
| 1. | 12 m Two seam fish trawl net | 6 |
| 2. | 14 m Two seam fish trawl net | 7 |
| 3. | 15 m Two seam fish trawl net | 8 |
| 4. | 16.5 m Two seam fish trawl net | 9 |
| 5. | 20 m Two seam fish trawl net | 10 |
| 6. | 24 m Two seam fish trawl net | 11 |
| 7. | 24 m Modified two seam fish trawl net | 12 |
| 8. | 30 m Two seam fish trawl net | 13 |
| 9. | 35 m Two seam fish trawl net | 14 |
| 10. | 45 m Two seam fish trawl net | 15 |
| 11. | 17 m Four seam shrimp trawl net | 16 |
| 12. | 18 m Four seam shrimp trawl net | 17 |
| 13. | 27 m Four seam shrimp trawl net | 18 |
| 14. | 28 m Four seam shrimp trawl net | 19 |
| 15. | 43.6 m Four seam shrimp trawl net | 20 |

## 7. DESCRIPTION OFTRAWL GEARS OPERATED BY E.F.P.

Data sheets and construction drawings are used to present maximum possible information. Fig. 6-20 gives the data and construction drawings of trawl gears operated by the E.F.P. since the inception of the Project. The cost particulars of each of the gears are given in Appendices 1-15.

### CONVENTIONS ADOPTED IN DATA SHEETS

Each data sheet consists of five sections - the first enumerates the general conditions of operation, the second specifies the webbing, the third specifies the lines and ropes, the forth the floats and sinkers and the last section is for other vital information.

### 7.1. Webbing:

The various netting panels are specified in capital letters which are cross-referenced with the drawings.

Material: Cotton, manila, polyethylene, polypropylene are all taken as names being in common use and are used as such.

Type of knot : All nettings are made of single sheet bend knots.

Preservation : Wherever preserved, name of the preservative is indicated.

Colour: Whenever preserved, the colour after preservation is specified. In case of untreated webbing, the original colour is noted.

Twine size : Expressed in diameter taking millimeter as the unit.

Breaking strength: Indicated in Kgf (Kilograme force) for conversion to the unit newton (N) adopted by International System of Units: 1 Kgf = 9.8 N

Twine surface area : For the whole of webbing is given in $m^2$.

Stretched mesh : Mesh sizes are given in millimeters. True mesh size is used, that is, the length of one lumen plus knot with the meshes stretched.

Upper edge : The number of meshes along top of each panel is given.

Lower edge : The number of meshes along bottom of each panel is taken.

Depth : The number of meshes down the side of each panel is taken.

Baiting rate : Where the panel tapers differently on its two edges, then the baiting rate for both the inner and outer edge is specified on successive lines.

Take up : The joining of different panels is indicated by a simple ratio of the number of meshes of one panel joined to the number of meshes in the other.

Quantity : The total quantity of webbing is noted in kgs.

Hanging : The ratio of attachment of webbing of two supporting lines or rope is given.

7.2. Lines and ropes:

The various lines and ropes are designated in lower case letters, using subscript numerals wherever necessary. These letters are cross-referenced with the drawings.

Material : Manila, combination rope, galvanised flexible steel wire are all taken as names being in common use and are used as such. Wherever combination rope is used the components are specified.

Construction: The number of strands are given. In case of steel wire details of inner core also specified.

Diameter : In all cases, this is specified in millimeter.

Breaking strength : In all cases, this is specified in Kgf (Kilogram force).

7.3. Conventions adopted in drawings:

The construction drawing contains the following details which also appear in data sheet.

1. The number of meshes at the top and bottom of each panel.
2. The depth, in number of meshes, of each panel.
3. The mesh size of panels in millimeters.
4. The material used and twine size of the panel.
5. The fabrication detail of the panels - either single braided or double braided.
6. The baiting rates in each panel.
7. The length of ropes - section-wise - in meters.

# FIG. 6 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 10·4 – 11·28 m. est.
G.R.T. : 9·9 – 12·80
H.P. : 42 – 56
TRAWLING SPEED : 2·5 KNOTS
CREW : 6

OTTER BOARD : OVAL 50 – 55 Kgs.
PLACE OF OPERATION : EAST AND WEST COAST OF INDIA
TYPES OF FISH CAUGHT :

| WEBBING | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | COTTON TWINE 20'S×15×3 | | | — | — |
| TYPE OF KNOT | — | — | SINGLE SHEET BEND | | | — | — |
| PRESERVATION | — | — | — | CUTCH | — | — | — |
| COLOUR | — | — | DARK BROWN | | | — | — |
| TWINE SIZE ø | — | — | — | 2 mm | — | — | — |
| BREAKING STRENGTH | — | — | — | 18·8 | — | — | — |
| TWINE SURFACE AREA $m^2$ | — | — | — | 11·100 | — | — | — |
| STRETCHED MESH mm | 120 | 120 | 120 | 100 | 80 | 60 | 45 |
| UPPER EDGE m. | 16 | 3 | 124 | 96 | 68 | 50 | 60 |
| LOWER EDGE m. | 42 | 26 | 96 | 68 | 34 | 50 | 60 |
| DEPTH m | 39 | 67 | 28 | 28 | 34 | 25 | 80 |
| HANGING RATE inner / outer | 1 : 1<br>1 : 3 | 1 : 1<br>1 : 15 | 1 : 2 | 1 : 2 | 1 : 2 | NIL | NIL |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{D}=\frac{1}{1}$ | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{F}=\frac{2}{3}$ | $\frac{F}{G}=\frac{3}{5}$ | |
| QUANTITY Kg | | | | | | | |
| HANGING | $\frac{a1}{A}=0·98$ | $\frac{b1}{B}=0·95$ | $\frac{a2}{C}=0·50$ | $\frac{b2}{D}=0·55$ | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | b | $b_1$ | $b_2$ | c |
|---|---|---|---|---|---|---|---|
| MATERIAL | — COMBINATION ( MANILA & WIRE ) — | | | | | — | MANILA ROPE |
| CONSTRUCTION | — CABLE LAID — (6 STRANDS) | | | | | — | (3 STRANDS) |
| DIAMETRE mm | — | — | — 14 — | | | — | 10 |
| BREAKING STRENGTH | | | | | | | 700 |
| LENGTH m. | 2·5 | 4·7 | 2·4 | 0·5 | 7·6 | 2·4 | 12·7 |

| FLOATS / SINKERS | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER m. | 150 | 130 | 6 |
| MATERIAL | Al. | AL | G.I.CHAIN |
| NUMBER | 1 | 16 | |
| SHAPE | — ○ — | | |
| LENGTH m. | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 18–20 |
| WEIGHT SUBMERGED Kg. | | | |

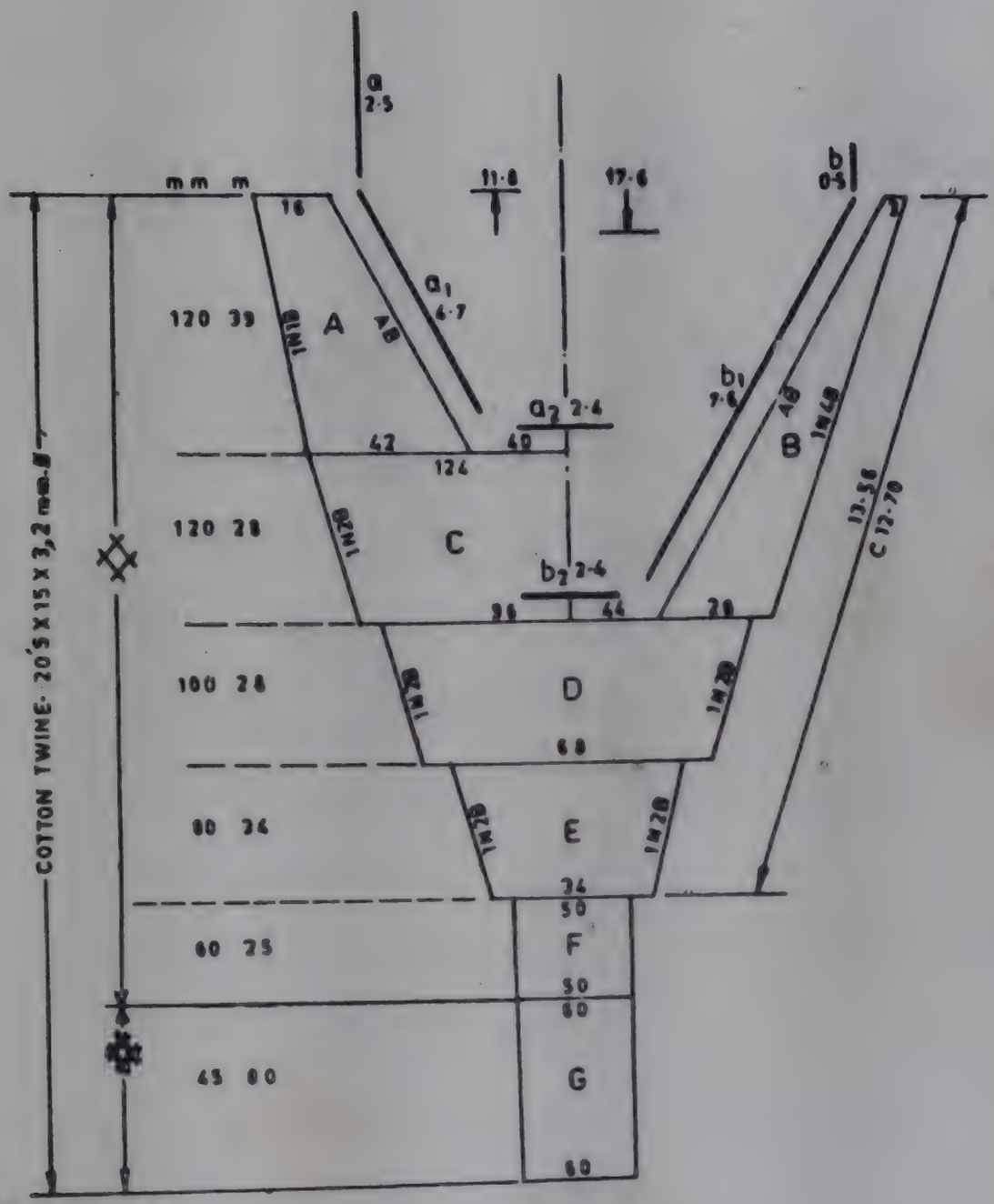
HEAD ROPE :- 11·8 m.

FOOT ROPE :- 17·6 m.

BOLCH LINE :- NYLON ROPE 5 mm. ø

COST PARTICULARS : SEE APPENDIX NO.1

# 12 m. TWO SEAM FISH TRAWL NET



# FIG. 7. DATA AND CONSTRUCTION DRAWING OF

VESSELS : 14.3 m. ocl.

G.R.T. : 34.5

H.P. : 135 – 165

TRAWLING SPEED : 3 KNOTS

CREW : 6

OTTER BOARD : OVAL 80 - 85 Kgs.

PLACE OF OPERATION : EAST AND WEST COAST OF INDIA

TYPES OF FISH CAUGHT :

| WEBBING | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | COTTON TWINE 20'S X 18 X 3 | | | | |
| TYPE OF KNOT | — | — | SINGLE SHEET BEND | | | | |
| PRESERVATION | — | — | — | CUTCH | | | |
| COLOUR | — | — | — | DARK BROWN | | | |
| TWINE SIZE ⌀ | — | — | — | 2·2 mm. | | | |
| BREAKING STRENGTH | — | — | — | 22·6 | | | |
| TWINE SURFACE AREA $m^2$ | — | — | — | 19·521 | | | |
| STRETCHED MESH mm. | 120 | 120 | 120 | 100 | 80 | 60 | 50 |
| UPPER EDGE m. | 23 | 8 | 174 | 130 | 92 | 72 | 72 |
| LOWER EDGE m. | 62 | 35 | 130 | 92 | 54 | 72 | 72 |
| DEPTH m. | 46 | 79 | 33 | 38 | 38 | 30 | 80 |
| BAITING RATE inner / outer | 1:1 / 1.6·5 | 1:1 / 1:1·5 | 1:1·5 | 1:2 | 1:2 | | |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{D}=\frac{1}{1}$ | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{F}=\frac{\pi}{4}$ | $\frac{F}{G}=\frac{1}{1}$ | |
| QUANTITY Kg | | | | | | | |
| HANGING | $\frac{a1}{A}=1.00$ | $\frac{b1}{B}=0.98$ | $\frac{a2}{C}=0.50$ | $\frac{b2}{D}=0.50$ | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | b | $b_1$ | $b_2$ | c |
|---|---|---|---|---|---|---|---|
| MATERIAL | — COMBINATION ( MANILA & WIRE ) — | | | | | | MANILA ROPE |
| CONSTRUCTION | — CABLE LAID — ( 6 STRANDS ) — | | | | | | (3 STRANDS) |
| DIAMETER mm. | — | — | — | 14 | — | — | 10 |
| BREAKING STRENGTH | | | | | | | 700 |
| LENGTH m. | 2·5 | 5·5 | 3·0 | 0·5 | 9·5 | 3·0 | 15·3 |

| FLOATS, SINKERS | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER mm. | 200 | 153 | 9 |
| MATERIAL | Al. | Al. | G.I CHAIN |
| NUMBER | 1 | 16 | |
| SHAPE | — ○ — | | |
| LENGTH m. | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 22-24 |
| WEIGHT SUBMERGED Kg. | | | |

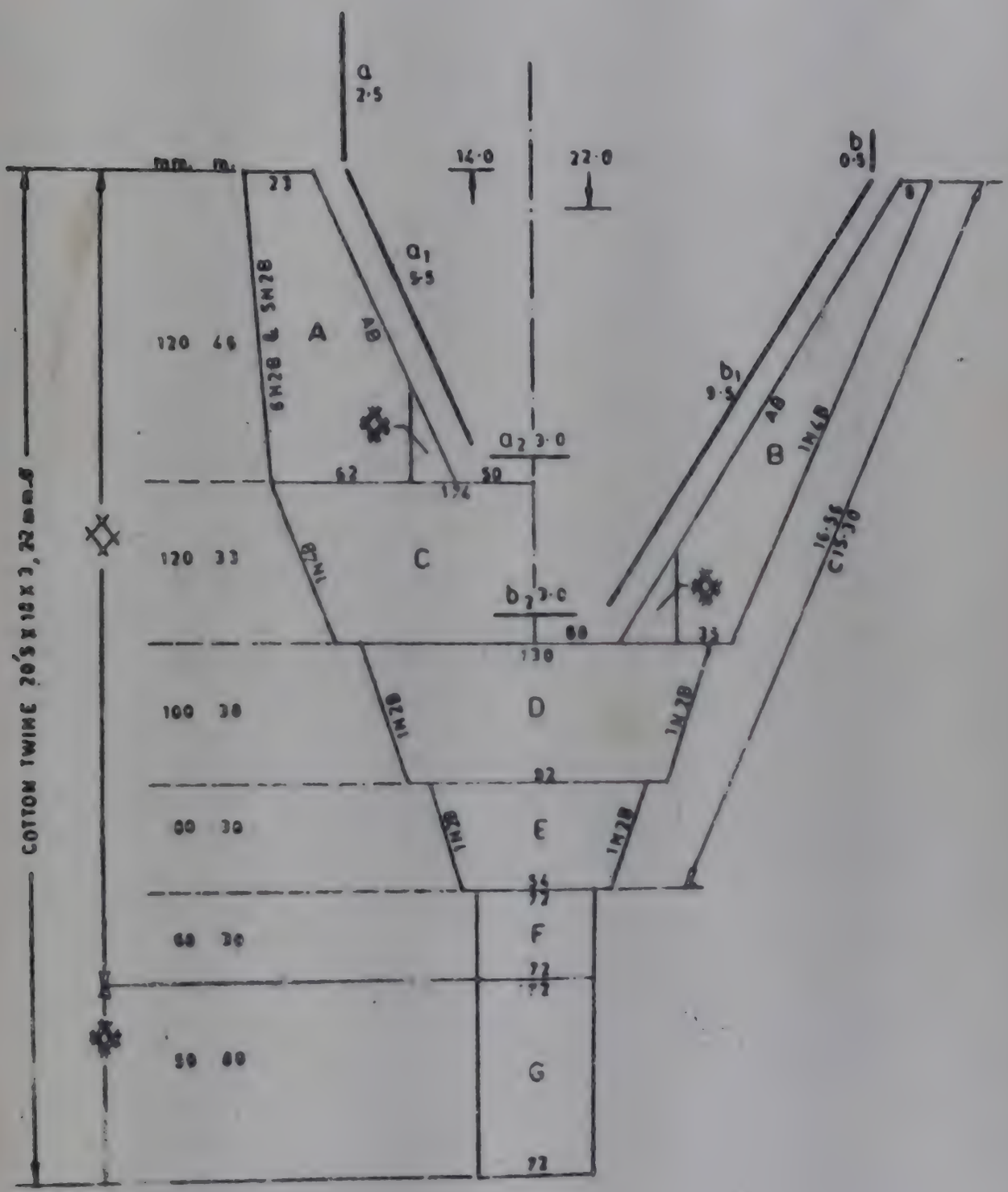
HEAD ROPE :- 14m.

FOOT ROPE :- 22m.

BOLCH LINE :- NYLON OR PE. ROPE 6mm ⌀

COST PARTICULARS: SEE APPENDIX NO.2 .

# 14 m. TWO SEAM FISH TRAWL NET.



# FIG. 8 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 26 m. oal.

G.R.T. : 91·7

H.P. : 240

TRAWLING SPEED : 3 KNOTS

CREW : 14

OTTER BOARD : OVAL 180 -200 Kgs.

PLACE OF OPERATION : EAST AND WEST COAST OF INDIA

TYPES OF FISH CAUGHT :

| WEBBING | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | COTTON TWINE 20'S X 20 X 3 OR MANILA TWINE | | | | | — |
| TYPE OF KNOT | — | — | SINGLE SHEET BEND | | | | | — |
| PRESERVATION | — | — | — | CUTCH | | | | — |
| COLOUR | — | — | DARK BROWN | | | | | — |
| TWINE SIZE Ø | — | — | — | 2·5 mm | | | | — |
| BREAKING STRENGTH Kg | — | — | — | 25 | | | | — |
| TWINE SURFACE AREA $m^2$ | — | — | — | 22 477 | | | | — |
| STRETCHED MESH mm. | 140 | 140 | 140 | 120 | 100 | 80 | 60 | 50 |
| UPPER EDGE m. | 21 | 5 | 15 | 11·2 | 9·6 | 8·0 | 7·0 | 8·0 |
| LOWER EDGE m | 5·3 | 3·1 | 11·2 | 9·6 | 8·0 | 5·2 | 7·0 | 8·0 |
| DEPTH m | 4·5 | 7·8 | 3·3 | 2·4 | 2·0 | 2·8 | 2·5 | 8·0 |
| BAITING RATE inner / outer | 1:1 / 1:4·5 | 1·1 / 1 1·5 | 1:1·5 | 1:3 | 1:3 | 1:2 | | |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{D}=\frac{1}{1}$ | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{F}=\frac{1}{1}$ | $\frac{F}{G}=\frac{5}{7}$ | $\frac{G}{H}=\frac{7}{8}$ | |
| QUANTITY Kg | | | | | | | | |
| HANGING | $\frac{a1}{A}=0.95$ | $\frac{b1}{B}=0.97$ | $\frac{a2}{C}=0.43$ | $\frac{b2}{D}=0.50$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | b | $b_1$ | $b_2$ | c |
|---|---|---|---|---|---|---|---|
| MATERIAL | — | — COMBINATION ( MANILA & WIRE ) — | | | | — | — MANILA ROPE |
| CONSTRUCTION | — | — CABLE LAID — | | — ( 6 STRANDS ) — | | — | — (3 STRANDS) |
| DIAMETRE mm | — | — | — | 20 | — | — | 16 |
| BREAKING STRENGTH Kg. | | | | | | | 2000 |
| LENGTH m. | 2·5 | 6·0 | 3·0 | 0·5 | 9·8 | 3·0 | 16·8 |

| FLOATS, SINKERS | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER mm. | 250 | 200 | 9 |
| MATERIAL | Al. | Al. | G.I.CHAIN |
| NUMBER | 1 | 18 | |
| SHAPE | — ○ — | | |
| LENGTH m. | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 32-37 |
| WEIGHT SUBMERGED Kg. | | | |

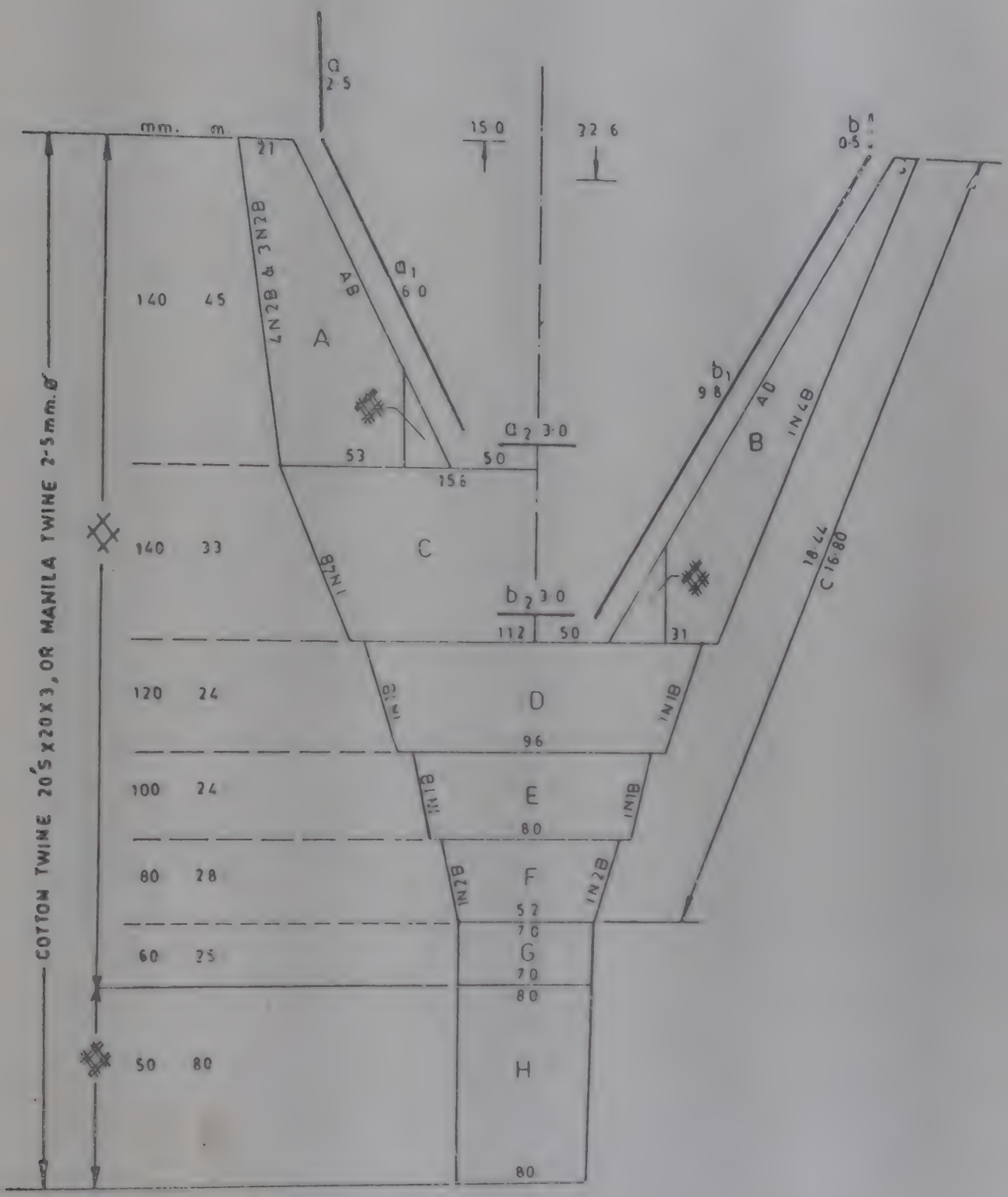
HEAD ROPE :- 15m.

FOOT ROPE :- 22·6 m.

BOLCH LINE -NYLON ROPE 8 mm. Ø

COST PARTICULARS : SEE APPENDIX NO. 3

# 15 m. TWO SEAM FISH TRAWL NET.



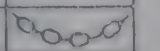
# FIG. 9 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 26 30 m. oal.
G.R.T. : 91·7 — 123·2
H.P. : 240 — 300
TRAWLING SPEED : 3 KNOTS
CREW : 14

OTTER BOARD : OVAL 200 Kg.
PLACE OF OPERATION : EAST AND WEST COAST OF INDIA
TYPES OF FISH CAUGHT :

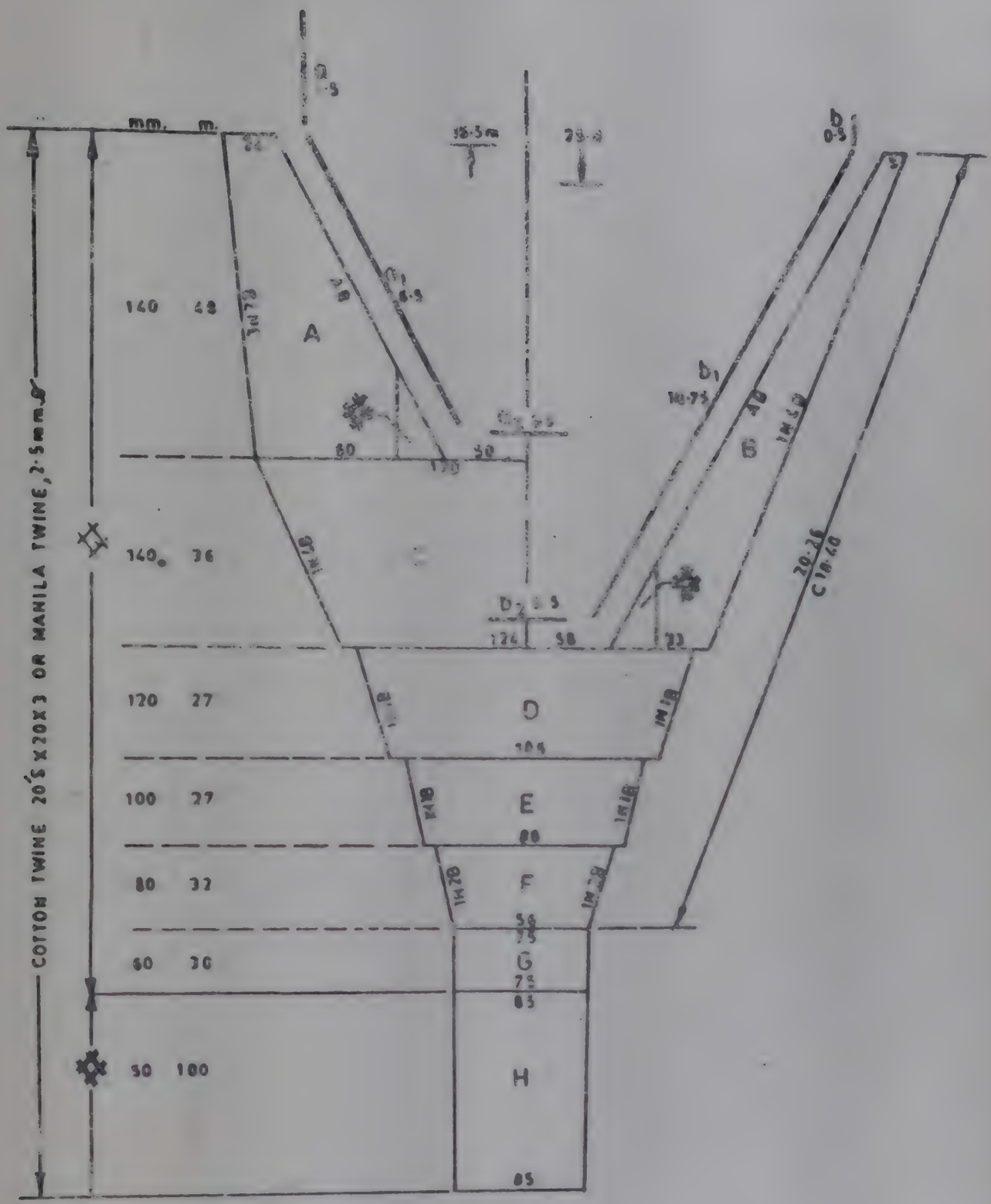
| WEBBING | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | COTTON TWINE 20'S X 20 X 3 OR MANILA TWINE | | | | | | — |
| TYPE OF KNOT | — | — | SINGLE SHEET BEND | | | | | — |
| PRESERVATION | — | — | — | CUTCH | | | | — |
| COLOUR | — | — | — | DARK BROWN | | | | — |
| TWINE SIZE Ø | — | — | — | 2·5 mm | | | | — |
| BREAKING STRENGTH | — | — | — | 25 | | | | — |
| TWINE SURFACE AREA $m^2$ | — | — | — | 28 148 | | | | — |
| STRETCHED MESH mm. | 140 | 140 | 140 | 120 | 100 | 80 | 60 | 50 |
| UPPER EDGE m. | 24 | 5 | 170 | 124 | 106 | 88 | 75 | 85 |
| LOWER EDGE m. | 60 | 33 | 124 | 106 | 88 | 56 | 75 | 85 |
| DEPTH m. | 48 | 84 | 36 | 27 | 27 | 32 | 30 | 100 |
| BAITING RATE inner / outer | 1:1 / 1:4 | 1:1 / 1:1·5 | 1:1·5 | 1:3 | 1:3 | 1:2 | | |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{G}=\frac{1}{1}$ | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{F}=\frac{1}{1}$ | $\frac{F}{G}=\frac{3}{4}$ | $\frac{G}{H}=\frac{15}{17}$ | |
| QUANTITY Kg | | | | | | | | |
| HANGING | $\frac{a1}{A}=0.97$ | $\frac{b1}{B}=0.91$ | $\frac{a2}{C}=0.50$ | $\frac{b2}{D}=0.50$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | b | $b_1$ | $b_2$ | c |
|---|---|---|---|---|---|---|---|
| MATERIAL | — | COMBINATION (MANILA & WIRE) | — | — | — | — | MANILA ROPE |
| CONSTRUCTION | — | CABLE LAID (6 STRANDS) | — | — | — | — | (3 STRANDS) |
| DIAMETER mm. | — | — | — | 20 | — | — | 16 |
| BREAKING STRENGTH | | | | | | | 2030 |
| LENGTH m. | 2·50 | 6·50 | 3·50 | 0·50 | 10·75 | 2·50 | 19·40 |

| FLOATS, SINKERS | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER mm. | 250 | 200 | 9 |
| MATERIAL | Al. | Al. | G.I. CHAIN |
| NUMBER | 1 | 20 | |
| SHAPE | — ○ — | |  |
| LENGTH m | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 35·40 |
| WEIGHT SUBMERGED Kg. | | | |

HEAD ROPE :- 16·5 m.
FOOT ROPE :- 25·0 m.
BOLCH LINE :- NYLON ROPE 8 mm. Ø
COST PARTICULARS SEE APPENDIX NO. 4

# 16·5m. TWO SEAM FISH TRAWL NET.



# FIG. 10 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 16·8 - 17·5 m.eal.
G.R.T. : 48·7 - 56·8
H.P. : 153 - 210
TRAWLING SPEED : 3 KNOTS
CREW : 7-10

OTTER BOARD : OVAL 180 Kg.
PLACE OF OPERATION : EAST AND WEST COAST OF INDIA
TYPES OF FISH CAUGHT :

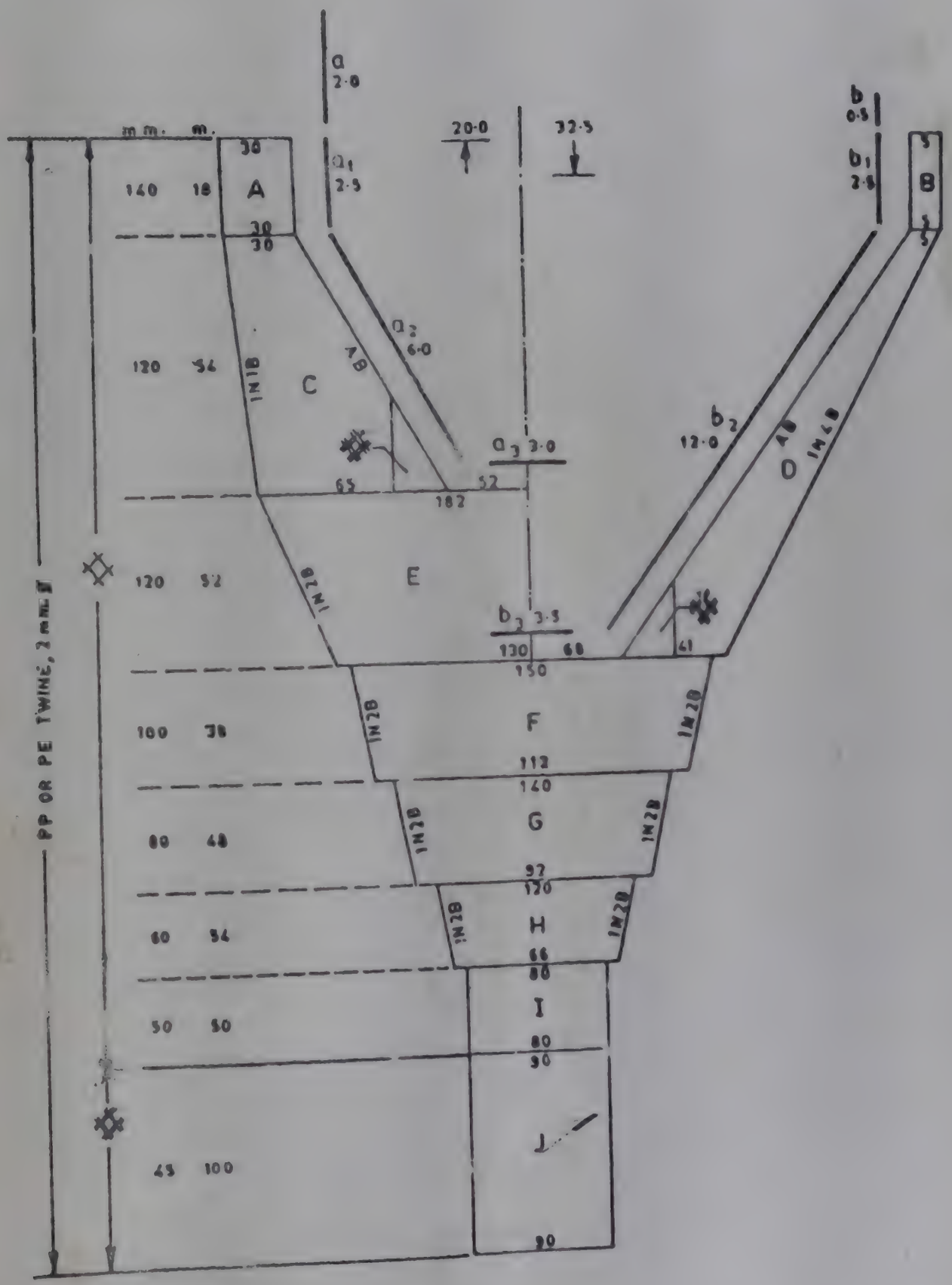
| WEBBING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | — | — | PP OR PE | | | | | — |
| TYPE OF KNOT | — | — | — | SINGLE SHEET BEND | | | | | | — |
| PRESERVATION | — | — | — | — | NIL | | | | | — |
| COLOUR | — | — | — | — | BLUE | | | | | — |
| TWINE SIZE ⌀ | — | — | — | — | 2 mm. | | | | | — |
| BREAKING STRENGTH | — | — | — | — | 36 | | | | | — |
| TWINE SURFACE AREA $m.^2$ | — | — | — | — | 29·039 | | | | | — |
| STRETCHED MESH mm. | 140 | 140 | 120 | 120 | 120 | 100 | 80 | 60 | 50 | 45 |
| UPPER EDGE m. | 30 | 5 | 30 | 5 | 182 | 150 | 140 | 170 | 80 | 90 |
| LOWER EDGE m. | 30 | 5 | 65 | 41 | 130 | 112 | 92 | 66 | 80 | 90 |
| DEPTH m. | 18 | 18 | 54 | 106 | 52 | 38 | 48 | 54 | 90 | 100 |
| BAITING RATE inner / outer | NIL | NIL | 1:1 / 1:3 | 1:1 / 1:1·5 | 1:2 | 1:2 | 1:2 | 1:2 | NIL | NIL |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{E}=\frac{1}{1}$ | $\frac{D}{F}=\frac{1}{1}$ | $\frac{E}{F}=\frac{13}{15}$ | $\frac{F}{G}=\frac{7}{6}$ | $\frac{G}{H}=\frac{7}{6}$ | $\frac{H}{I}=\frac{6}{7}$ | $\frac{I}{J}=\frac{8}{8}$ | |
| QUANTITY Kg | | | | | | | | | | |
| HANGING | $\frac{a_1}{A}=0.99$ | $\frac{b_1}{B}=0.99$ | $\frac{a_2}{C}=0.93$ | $\frac{b_2}{D}=0.94$ | $\frac{a_3}{E}=0.48$ | $\frac{b_3}{F}=0.51$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | $a_3$ | b | $b_1$ | $b_2$ | $b_3$ |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | GALVANISED FLEXIBLE STEEL WIRE ROPE | | | | | | | |
| CONSTRUCTION | — | 6X19 WITH INNER FIBRE CORE | | | | | | |
| DIAMETER mm. | — | — | — | 9 | | | | |
| BREAKING STRENGTH | — | — | — | 160/$mm.^2$ | | | | |
| LENGTH m. | 2·0 | 2·5 | 6·0 | 3·0 | 0·5 | 2·5 | 12·0 | 3·5 |

| FLOATS / SINKERS. | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 200 | 9 |
| MATERIAL | PLASTIC | G.I.CHAIN |
| NUMBER | 10-12 | |
| SHAPE | ○ |  |
| LENGTH m. | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 30-35 |
| WEIGHT SUBMERGED Kg. | | |

HEAD ROPE : 20 m.
FOOT ROPE : 32·5 m.
BOLCH LINE : NYLON ROPE 8 mm. ⌀
COST PARTICULARS SEE APPENDIX NO.5

# 20 m. TWO SEAM FISH TRAWL NET.



# FIG. 11 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 16·8 & 17.5 m. ocl.
G.R.T. : 49–57
H.P. : 153–210
TRAWLING SPEED : 3 KNOTS
CREW : 7–10

OTTER BOARD : OVAL 180 Kg.
PLACE OF OPERATION : EAST AND WEST COAST OF INDIA
TYPES OF FISH CAUGHT :

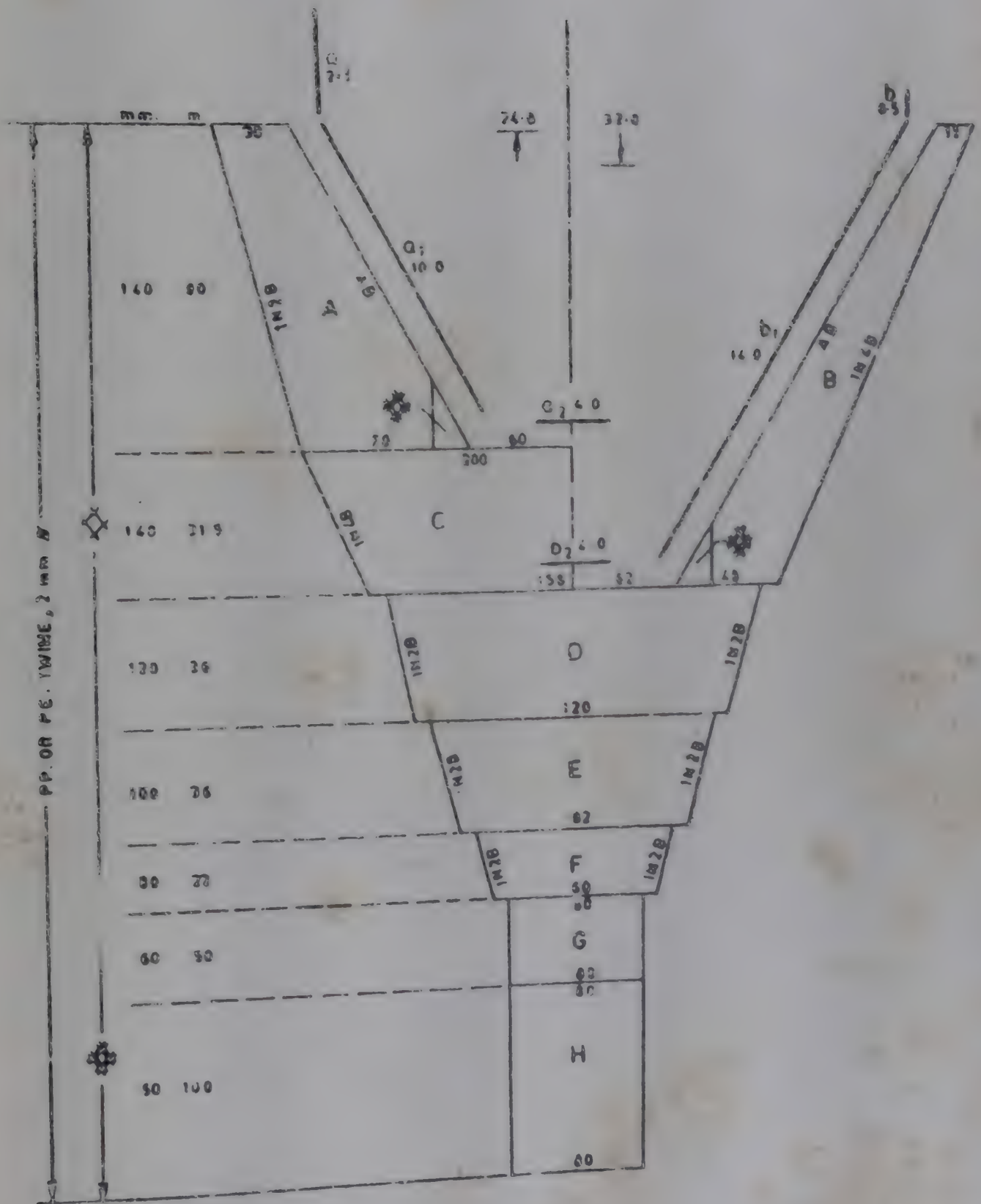
| WEBBING | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | PP OR PE | | | | | | |
| TYPE OF KNOT | — | — | SINGLE SHEET BEND | | | | | |
| PRESERVATION | — | — | — | NIL | | | | |
| COLOUR | — | — | — | BLUE | | | | |
| TWINE SIZE ⌀ | — | — | — | 2 mm. | | | | |
| BREAKING STRENGTH | — | — | — | 36 | | | | |
| TWINE SURFACE AREA $m^2$ | — | — | — | 30·275 | | | | |
| STRETCHED MESH mm. | — | 140 | — | 120 | 100 | 80 | 60 | 50 |
| UPPER EDGE m. | 30 | 11 | 200 | 158 | 120 | 82 | 80 | 80 |
| LOWER EDGE m. | 70 | 48 | 158 | 120 | 82 | 60 | 80 | 80 |
| DEPTH m. | 80 | 111·5 | 31·5 | 36 | 36 | 22 | 50 | 100 |
| HANGING RATE inner / outer | 1:1 / 1:2 | 1:1 / 1:1·5 | 1:1·5 | 1:2 | 1:2 | 1:2 | NIL | |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{D}=\frac{1}{1}$ | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{F}=\frac{1}{1}$ | $\frac{F}{G}=\frac{3}{4}$ | $\frac{G}{H}=\frac{1}{1}$ | |
| QUANTITY Kg | | | | | | | | |
| HANGING | $\frac{a1}{A}=0·89$ | $\frac{b1}{B}=0·89$ | $\frac{a2}{C}=0·48$ | $\frac{b2}{D}=0·46$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | b | $b_1$ | $b_2$ |
|---|---|---|---|---|---|---|
| MATERIAL | — GALVANISED FLEXIBLE STEEL WIRE ROPE — | | | | | |
| CONSTRUCTION | — 6 X 24 OR 6 X 19 WITH INNER FIBRE CORE — | | | | | |
| DIAMETER mm. | — | — | — 11 — | | — | — |
| BREAKING STRENGTH | — | — | — 180/$mm^2$ — | | — | — |
| LENGTH m. | 2·5 | 10 | 4 | 0·5 | 14 | 4 |

| FLOATS, SINKERS | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER mm. | 250 | 200 | 9 |
| MATERIAL | Al. | Al. | G.I. CHAIN |
| NUMBER | 1 | 10–12 | |
| SHAPE | — ○ — | | |
| LENGTH m. | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 45–50 |
| WEIGHT SUBMERGED Kg. | | | |

HEAD ROPE :- 24.0 m.
FOOT ROPE :- 32.0 m.
BOLCH LINE :- NYLON OR PE. ROPE 8 mm. ⌀
COST PARTICULARS : SEE APPENDIX NO. 6

# 24m. TWO SEAM FISH TRAWL NET.



# FIG 12 .DATA AND CONSTRUCTIONAL DRAWING OF

VESSELS : 17·5 m.o.a.l.

G.R.T : 57

H.P. : 200

TRAWLING SPEED : 2.5 – 3 KNOT

CREW : 10

OTTER BOARD : OVAL 100 Kg.

PLACE OF OPERATION : UPPER EAST COAST OF INDIA

TYPES OF FISH CAUGHT :

| WEBBING | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | PP OR PE | | | | | | — |
| TYPE OF KNOT | — | — | SINGLE SHEET BEND | | | | — | — |
| PRESERVATION | — | — | — | NIL | | | — | — |
| COLOUR | — | — | — | BLUE | | | — | — |
| TWINE SIZE ø | — | — | — | 3 mm | | | — | — |
| BREAKING STRENGTH | — | — | — | 30 | | | — | — |
| TWINE SURFACE AREA $m^2$ | — | — | — | | | | — | — |
| STRETCHED MESH : mm. | — | 70 | — | 35 | 17 | | 40 | — |
| UPPER EDGE m. | 80 | 22 | 400 | 316 | 208 | 184 | 200 | 100 |
| LOWER EDGE m. | 140 | 86 | 316 | 148 | 184 | 184 | 200 | 100 |
| DEPTH m. | 160 | 2×3 | 63 | 72 | 77 | 44 | 72 | 120 |
| BAITING RATE inner / outer | 1 : 1 / 1 : 1 | 1 : 1 / 1 : 5 | 1 : 5 | 1 : 2 | 1 : 1 | 1 : 1 | WP | NIL |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{E}=\frac{1}{1}$ | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{F}=\frac{1}{1}$ | $\frac{F}{G}=\frac{1}{1}$ | $\frac{G}{H}=\frac{1}{1}$ | |
| QUANTITY Kg | | | | | | | | |
| HANGING | $\frac{a1}{A}=0.89$ | $\frac{b1}{B}=0.5$ | $\frac{a2}{C}=0.5$ | $\frac{b2}{D}=0.5$ | | | | |

| LINES, ROPES | Q | $a_2$ | $a_1$ | b | $b_1$ | $b_2$ |
|---|---|---|---|---|---|---|
| MATERIAL | GALVANISED FLEXIBLE STEEL WIRE ROPE | | | | | |
| CONSTRUCTION | 6 X 24 OR 6 X 19 WITH INNER FIBRE CORE | | | | | |
| DIAMETER mm. | 11 | | | | | |
| BREAKING STRENGTH | 180/$mm^2$ | | | | | |
| LENGTH m. | 25 | 10 | 4 | 25 | 14 | 4 |

| FLOATS, SINKERS | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER mm. | 250 | 200 | 9 |
| MATERIAL | Al | Al | G.I.CHAIN |
| NUMBER | 1 | 14-15 | |
| SHAPE | — ○ — | | |
| LENGTH m. | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 14-15 |
| WEIGHT SUBMERGED Kg. | | | |

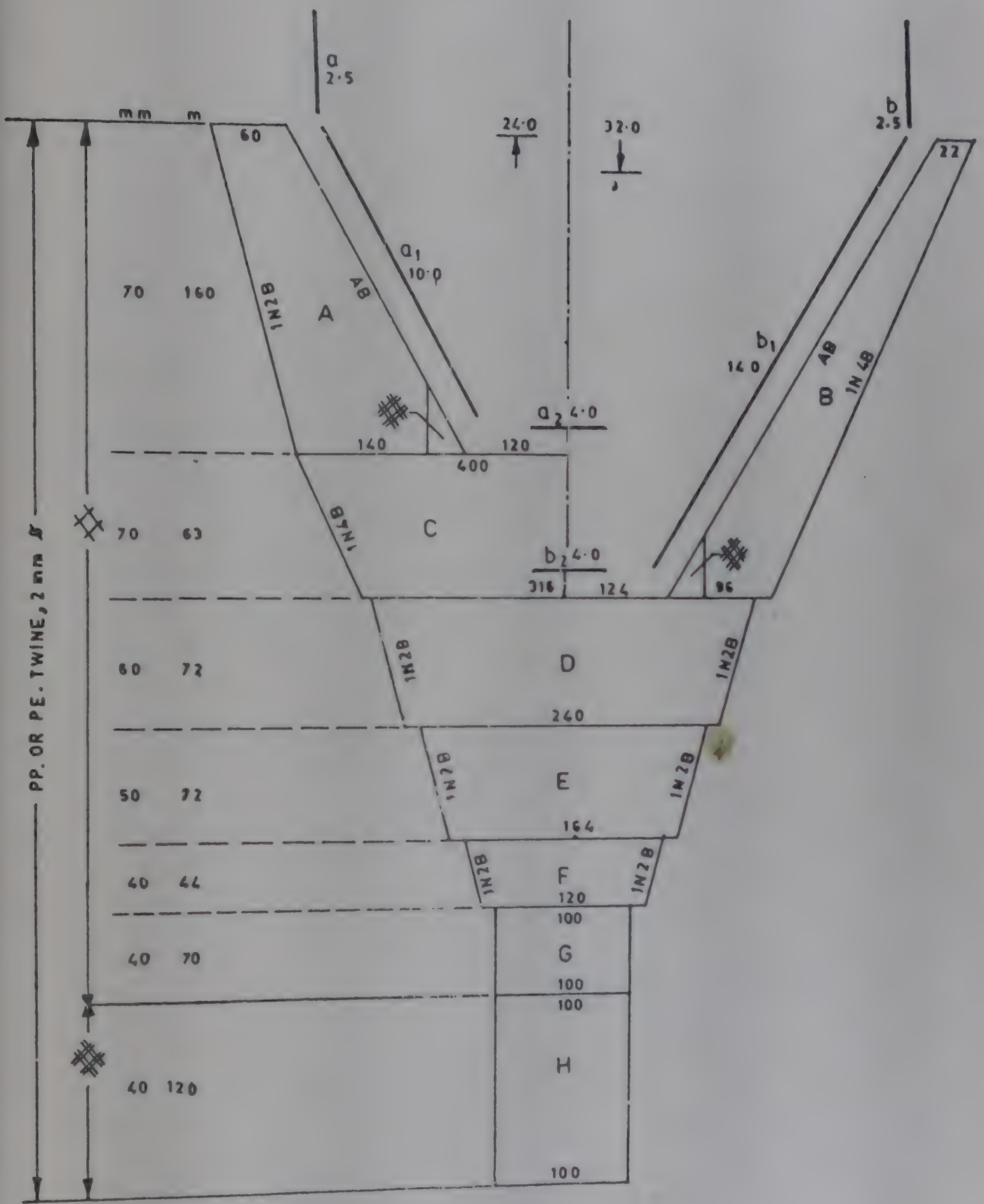
HEAD ROPE :- 24.0 m

FOOTROPE :- 32.0 m

BOLCH LINE :- NYLON OR PE ROPE 8 mm ø

COST PARTICULARS SEE APPENDIX NO.7

# 24 m. MODIFIED TWO SEAM FISH TRAWL NET.



# FIG. 13 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 22-31 m. eal.

G.R.T. : 69-123

H.P. : 262 – 308

TRAWLING SPEED : 3 KNOTS

CREW : 13-14

OTTER BOARD : OVAL 200 Kg.

PLACE OF OPERATION | EAST AND WEST COAST OF INDIA

TYPES OF FISH CAUGHT |

| WEBBING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | | | | PP. OR PE | | | | | — |
| TYPE OF KNOT | — | | | | SINGLE SHEET BEND | | | | | — |
| PRESERVATION | — | | | | NIL | | | | | — |
| COLOUR | — | | | | BLUE | | | | | — |
| TWINE SIZE ø | — | | | | 2 mm. | | | | | 2·5mm |
| BREAKING STRENGTH Kgf. | — | | | | 36 | | | | | — |
| TWINE SURFACE AREA $m^2$ | — | | | | 33·983 | | | | | 63 |
| STRETCHED MESH mm. | 140 | 140 | 140 | 140 | 140 | 120 | 100 | 80 | 60 | 50 |
| UPPER EDGE m. | 30 | 11 | 30 | 11 | 200 | 158 | 120 | 82 | 80 | 80 |
| LOWER EDGE m. | 30 | 11 | 70 | 48 | 158 | 120 | 82 | 60 | 80 | 80 |
| DEPTH m. | 25 | 25 | 80 | 111·5 | 31·5 | 36 | 36 | 22 | 50 | 100 |
| HANGING RATE inner / outer | NIL | NIL | 1:1 / 1:2 | 1:1 / 1:1·5 | 1:1·5 | 1:2 | 1:2 | 1:2 | NIL | NIL |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{E}=\frac{1}{1}$ | $\frac{D}{F}=\frac{1}{1}$ | $\frac{E}{F}=\frac{1}{1}$ | $\frac{F}{G}=\frac{1}{1}$ | $\frac{G}{H}=\frac{1}{1}$ | $\frac{H}{I}=\frac{1}{1}$ | $\frac{I}{J}=\frac{1}{1}$ | |
| QUANTITY Kg. | | | | | | | | | | |
| HANGING | $\frac{a1}{A}=0.86$ | $\frac{b1}{B}=0.86$ | $\frac{a2}{C}=0.89$ | $\frac{b2}{D}=0.89$ | $\frac{a3}{E}=0.48$ | $\frac{b3}{F}=0.48$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | $a_3$ | b | $b_1$ | $b_2$ | $b_3$ |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | GALVANISED FLEXIBLE STEEL WIRE ROPE | | | | | | — |
| CONSTRUCTION | — | 6X19 OR 6X24 WITH INNER FIBRE CORE | | | | | — | — |
| DIAMETER mm. | — | | | 11 | | | | — |
| BREAKING STRENGTH Kgf. | — | | | 180/$mm^2$ | | | | — |
| LENGTH m. | 2·5 | 3 | 10 | 4 | 0·5 | 3 | 14 | 4 |

| FLOATS, SINKERS. | FLOATS | | SINKERS |
|---|---|---|---|
| DIAMETER mm. | 250 | 200 | 8 |
| MATERIAL | Al. | Al. | G.I. CHAIN |
| NUMBER | 1 | 14–16 | |
| SHAPE | — ○ — | | |
| LENGTH m. | | | |
| STATIC BUOYANCY | | | |
| WEIGHT IN AIR Kg. | | | 50-55 |
| WEIGHT SUBMERGED Kg. | | | |

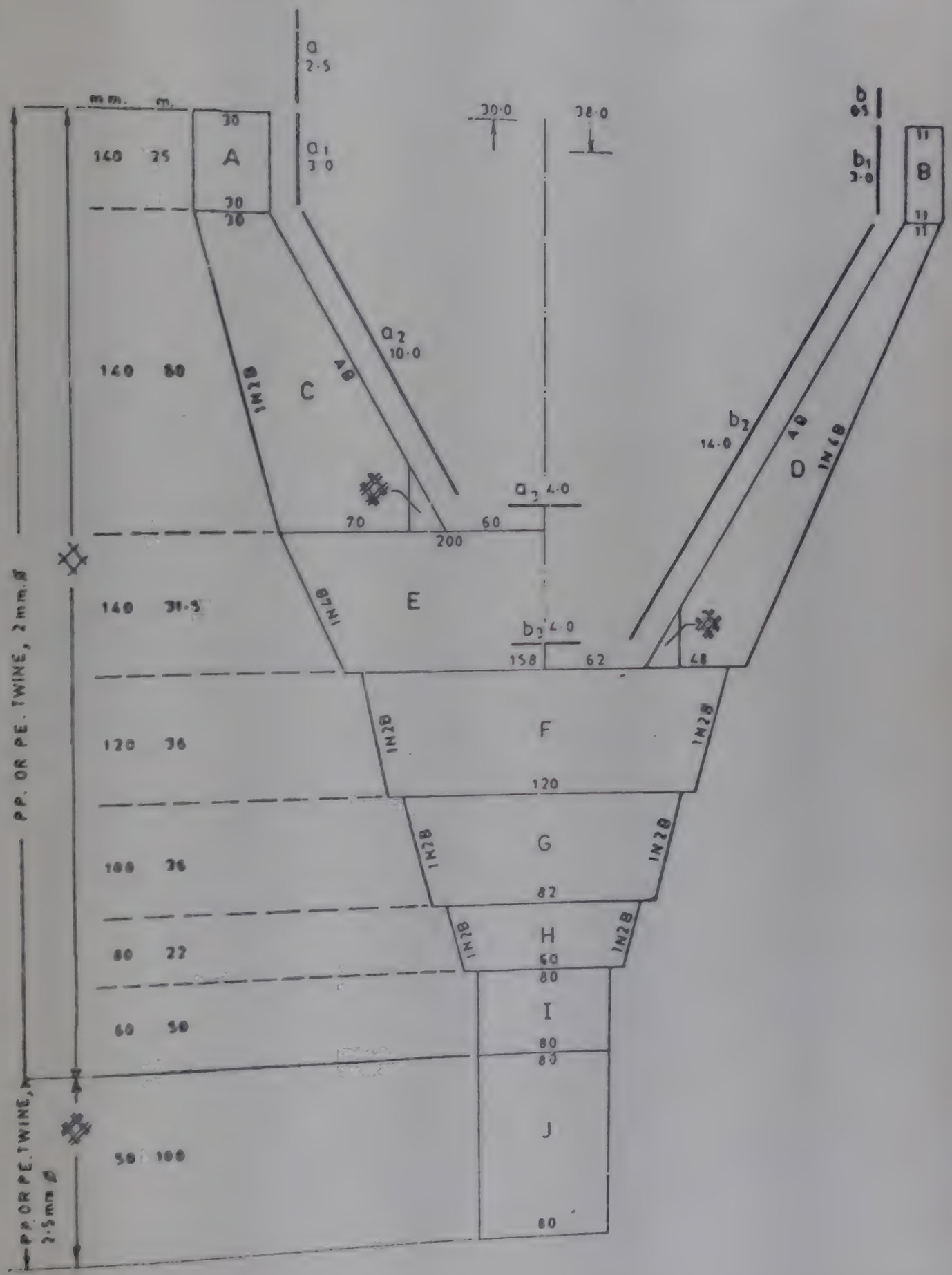
HEAD ROPE :- 30 m.

FOOT ROPE :- 38 m.

BOLCH LINE :- NYLON OR PE. ROPE 8 mm. ø

COST PARTICULARS : SEE APPENDIX NO. 8

# 30m. TWO SEAM FISH TRAWL NET.



# FIG 14 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 22·5 — 30·96

G.R.T. : 69·2 - 123·2

H.P. : 262 — 300

TRAWLING SPEED : 3 KNOTS

CREW : 13-14

OTTER BOARD : OVAL 250 Kgs.

PLACE OF OPERATION : EAST AND WEST COAST OF INDIA

TYPES OF FISH CAUGHT :

| WEBBING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | | | | PP OR PE | | | | | |
| TYPE OF KNOT | — | | | | SINGLE SHEET BEND | | | | | |
| PRESERVATION | — | | | | NIL | | | | | |
| COLOUR | — | | | | BLUE | | | | | |
| TWINE SIZE ø | — | | | | 2·5 mm. | | | | | |
| BREAKING STRENGTH | — | | | | 63 | | | | | |
| TWINE SURFACE AREA $m.^2$ | — | | | | 47·09 | | | | | |
| STRETCHED MESH mm. | 140 | 140 | 120 | 120 | 120 | 100 | 80 | 60 | 50 | 45 |
| UPPER EDGE m. | 34 | 12 | 34 | 12 | 234 | 186 | 146 | 106 | 100 | 110 |
| LOWER EDGE m. | 34 | 12 | 82 | 56 | 186 | 146 | 106 | 80 | 100 | 110 |
| DEPTH m | 40 | 40 | 95 | 131 | 36 | 40 | 40 | 26 | 60 | 100 |
| BAITING RATE inner / outer | NIL | NIL | 1·1 / 1 2 | 1 1 / 1 1·5 | 1 1·5 | 1:2 | 1:2 | 1:2 | NIL | NIL |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{E}=\frac{1}{1}$ | $\frac{D}{F}=\frac{1}{1}$ | $\frac{E}{F}=\frac{1}{1}$ | $\frac{F}{G}=\frac{1}{1}$ | $\frac{G}{H}=\frac{1}{1}$ | $\frac{H}{I}=\frac{2}{5}$ | $\frac{I}{J}=\frac{10}{11}$ | |
| QUANTITY Kg | | | | | | | | | | |
| HANGING | $\frac{a1}{A}=0.89$ | $\frac{b1}{B}=0.89$ | $\frac{a2}{C}=0.92$ | $\frac{b2}{D}=0.95$ | $\frac{a3}{E}=0.48$ | $\frac{b3}{F}=0.54$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | $a_3$ | b | $b_1$ | $b_2$ | $b_3$ |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | GALVANISED FLEXIBLE STEEL WIRE ROPE | | | | | | — |
| CONSTRUCTION | — | — | 6X19 WITH INNER FIBRE CORE | | | | — | — |
| DIAMETER mm. | — | — | — | 11 | | | — | — |
| BREAKING STRENGTH | — | — | — | 180/$mm.^2$ | | | — | — |
| LENGTH m. | 2·0 | 5·0 | 10 | 4·0 | 0·5 | 5·0 | 15·0 | 4·0 |

| FLOATS, SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 200 | 9 |
| MATERIAL | PLASTIC | G.I.CHAIN |
| NUMBER | 16-18 | |
| SHAPE | —○— | |
| LENGTH m | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 55-60 |
| WEIGHT SUBMERGED Kg. | | |

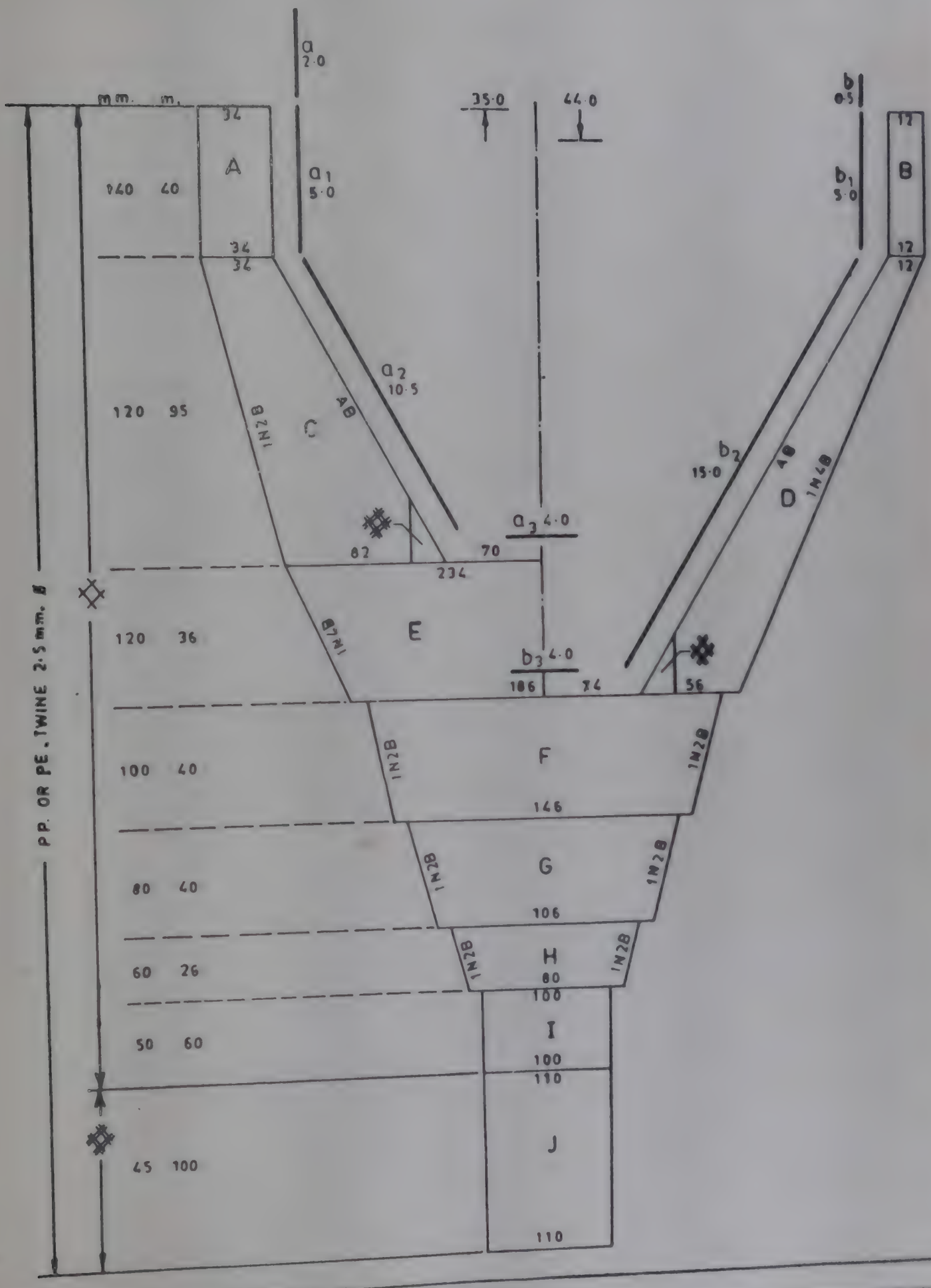
HEAD ROPE :- 35·0 m.

FOOT ROPE :- 44 m.

BOLCH LINE :- NYLON ROPE 8 mm. ø

COST PARTCULARS SEE APPENDIX NO. 9

# 35m. TWO SEAM FISH TRAWL NET.



# FIG. 15 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 30·96 - 32·28 m. oal.

G.R.T. : 123·2 - 182·6

H.P. : 300 - 578

TRAWLING SPEED : 3 - 3·5 KNOTS

CREW : 14 - 16

OTTER BOARD : RECTANGULAR 425 Kg.

PLACE OF OPERATION : UPPER EAST COAST AND NORTH WEST COAST OF INDIA

TYPES OF FISH CAUGHT :

| NETTING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | — | — | — PP OR PE — | — | — | — | — | — |
| TYPE OF KNOT | — | — | — | — | — SINGLE SHEET BEND — | — | — | — | — | — |
| PRESERVATION | — | — | — | — | — NIL — | — | — | — | — | — |
| COLOUR | — | — | — | — | — BLUE — | — | — | — | — | — |
| TWINE SIZE ⌀ | — | — | — | — | — * — | — | — | — | — | — |
| BREAKING STRENGTH | — | — | — | — | — 53 — | — | — | — | — | — |
| TWINE SURFACE AREA $m^2$ | — | — | — | — | — 76·857 — | — | — | — | — | — |
| STRETCHED MESH mm | 140 | 140 | 140 | 140 | 140 | 120 | 100 | 80 | 60 | 50 |
| UPPER EDGE m. | 45 | 15 | 45 | 75 | 100 | 134 | 165 | 131 | 100 | 100 |
| LOWER EDGE m. | 45 | 15 | 105 | 75 | 75 | 100 | 130 | 80 | 100 | 100 |
| DEPTH m | 38 | 38 | 120 | 170 | 50 | 50 | 50 | 50 | 50 | 100 |
| HANGING RATE inner / outer | NIL | NIL | 1:1 / 1:2 | 1:1 / 1:2·1 | 1:1·5 | 1:2 | 1:2 | 1:2 | NIL | NIL |
| TAKE UP | $\frac{A}{C}=\frac{1}{1}$ | $\frac{B}{D}=\frac{1}{1}$ | $\frac{C}{E}=\frac{1}{1}$ | $\frac{D}{F}=\frac{1}{1}$ | $\frac{E}{G}=\frac{1}{1}$ | $\frac{F}{H}=\frac{1}{1}$ | — | $\frac{H}{I}=\frac{1}{1}$ | $\frac{I}{J}=\frac{1}{1}$ | |
| QUANTITY Kg | | | | | | | | | | |
| HANGING | $\frac{a_1}{A}=0.86$ | $\frac{b_1}{B}=0.86$ | $\frac{a_2}{C}=0.65$ | $\frac{b_2}{D}=0.90$ | $\frac{a_3}{E}=0.79$ | $\frac{b_3}{F}=0.54$ | | | | |

| LINES, ROPES | a | $a_1$ | $a_2$ | $a_3$ | b | $b_1$ | $b_2$ | $b_3$ |
|---|---|---|---|---|---|---|---|---|
| MATERIAL | — GALVANISED FLEXIBLE STEEL WIRE ROPE — | | | | | | | |
| CONSTRUCTION | — | — | 6 X 19 WITH INNER FIBRE CORE | | | | | |
| DIAMETER mm. | — | — | — | 11 | — | — | — | — |
| BREAKING STRENGTH Kg. | — | — | — | 180/$mm^2$ | — | — | — | — |
| LENGTH m. | 2·5 | 4·5 | 15·0 | 6·0 | 0·5 | 4·5 | 21·5 | 6·0 |

| FLOATS, SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 200 | 9 |
| MATERIAL | Al. | G.I. CHAIN |
| NUMBER | 18-22 | |
| SHAPE | —○— | |
| LENGTH m. | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 70-80 |
| WEIGHT SUBMERGED Kg | | |

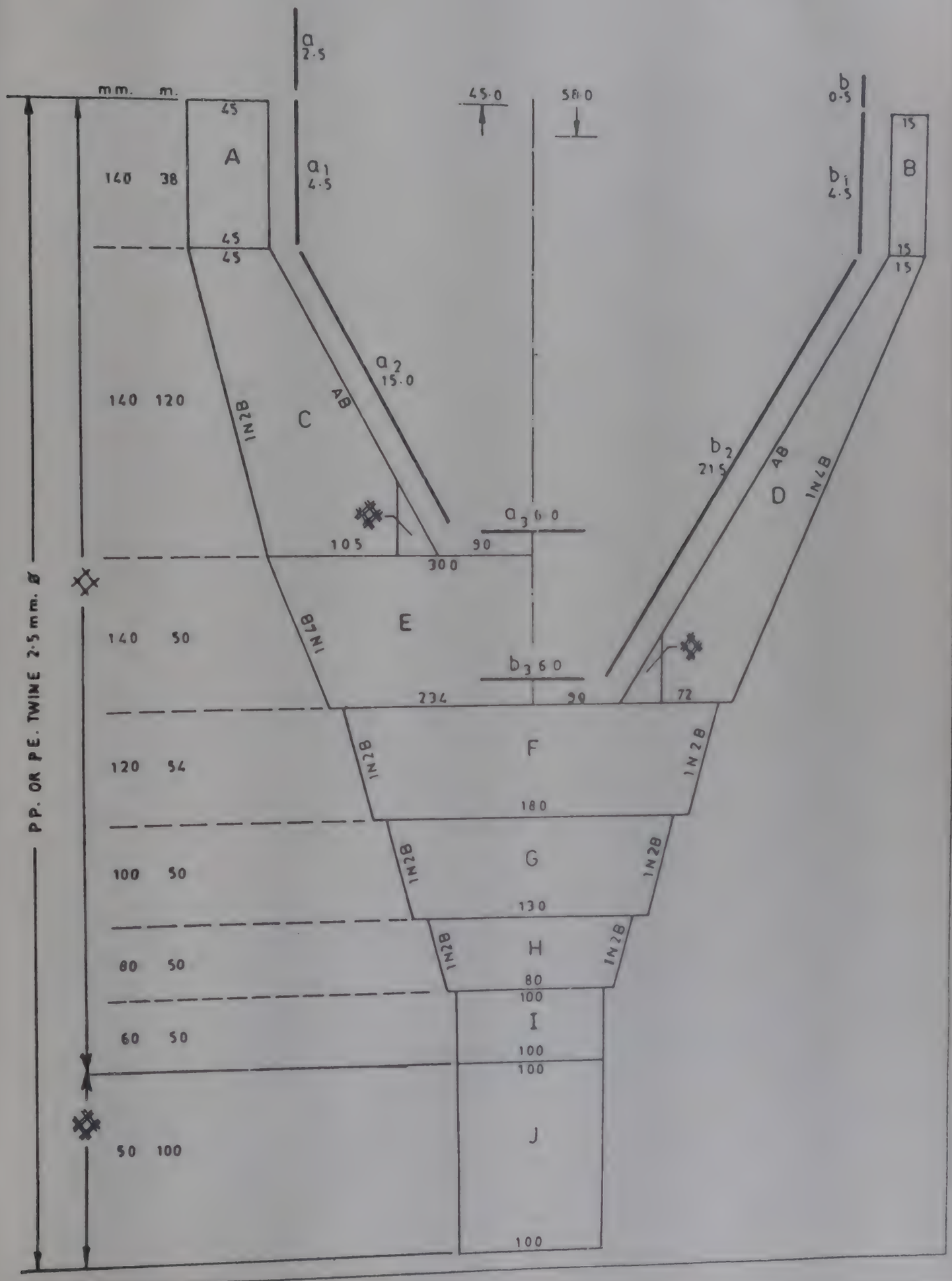
HEAD ROPE :- 45·0 m.

FOOT ROPE :- 53 m.

BOLCH LINE :- NYLON OR PE. ROPE 8 mm. ⌀

COST PARTICULARS: SEE APPENDIX NO. 10

# 45m. TWO SEAM FISH TRAWL NET.



| FLOATS SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 127 | |
| MATERIAL | Al. | LEAD |
| NUMBER | 15-17 | |
| SHAPE | —○— | ○ |
| LENGTH m. | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 20-22 |
| WEIGHT SUBMERGED Kg. | | |

HEAD ROPE :- 17.2 m

FOOT ROPE :- 17.2 m

BOLCH LINE :- COTTON ROPE 5mm. ø

COST PARTICULARS SEE APPENDIX NO. 11

# FIG.16 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 10·4 m. ont

O.R. 9·9 – 12·8

H.P. 42 – 58

TRAWLING SPEED 2 – 2·5 KNOTS

CREW 6

OTTER BOARD RECTAGULAR, 55-60 Kg.

PLACE OF OPERATION | WEST COAST OF INDIA

TYPES OF FISH CAUGHT

| WEBBING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — COTTON TWINE 20'S X 8 X 3, 20'S X 10 X 3, 20'S X 15 X 3 & 20'S X 20 X 3 — | | | | | | | | — |
| TYPE OF KNOT | — | — | | — SINGLE SHEET BEND — | | | | | | — |
| PRESERVATION | — | — | | — | — CUTCH — | | | | | — |
| COLOUR | — | — | | — | DARK BROWN — | | | | | — |
| TWINE SIZE ø | — | — | 1·5 mm. | — | — | 2·5 mm. | — | 3 mm. | — | 2 mm |
| B. S. | — | — | 11·1 | — | — | — | — | 24·1 | — | 22·6 |
| TWINE SURFACE AREA $m^2$ | — | — | — | — | 10·0 | — | — | — | — | — |
| S | 32 | 51 | 51 | 51 | 51 | 102 | 51 | 38 | 38 | 32 |
| | | 80 | 40 | | | | | 160 | 40 | 64 |
| | m | 80 | 32 | | | | | 54 | 2 | 6 |
| | | | | | | | | 80 | 80 | 150 |
| SA[illegible] RATIO | | | | | | | | | 1:4 1:4 | NIL |
| TAPE UP | | | | | | | | | | |
| QUANTITY Kg | | | | | | | | | | |
| HANGING | | | | | | | | | | |

| [illegible] | a | $a_1$ | [illegible] | $a_1$ | $b_2$ | $b_3$ | $b_4$ |
|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | — | — | — | — | — |
| [illegible]TION | — | — | CABLE [illegible] | — | — | — | — |
| [illegible]ER mm. | — | — | — | — | — | — | — |
| S[illegible]TH Kg. | — | 1600 | — | — | 2500 | — | — |
| LENGTH m | 1·0 | 1·4 | 2·4 | 3·2 | 3·2 | 1·0 | 1·4 | 2·4 | 3·2 | 3·2 |

| FLOATS SINKERS | FLOATS | [illegible]S |
|---|---|---|
| DIAMETER mm. | 12? | |
| MATERIAL | [illegible] | — |
| NUMBER | 15-17 | |
| SHAPE | —○— | ○ |
| LENGTH m. | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 20-22 |
| WEIGHT SUBMERGED Kg. | | |

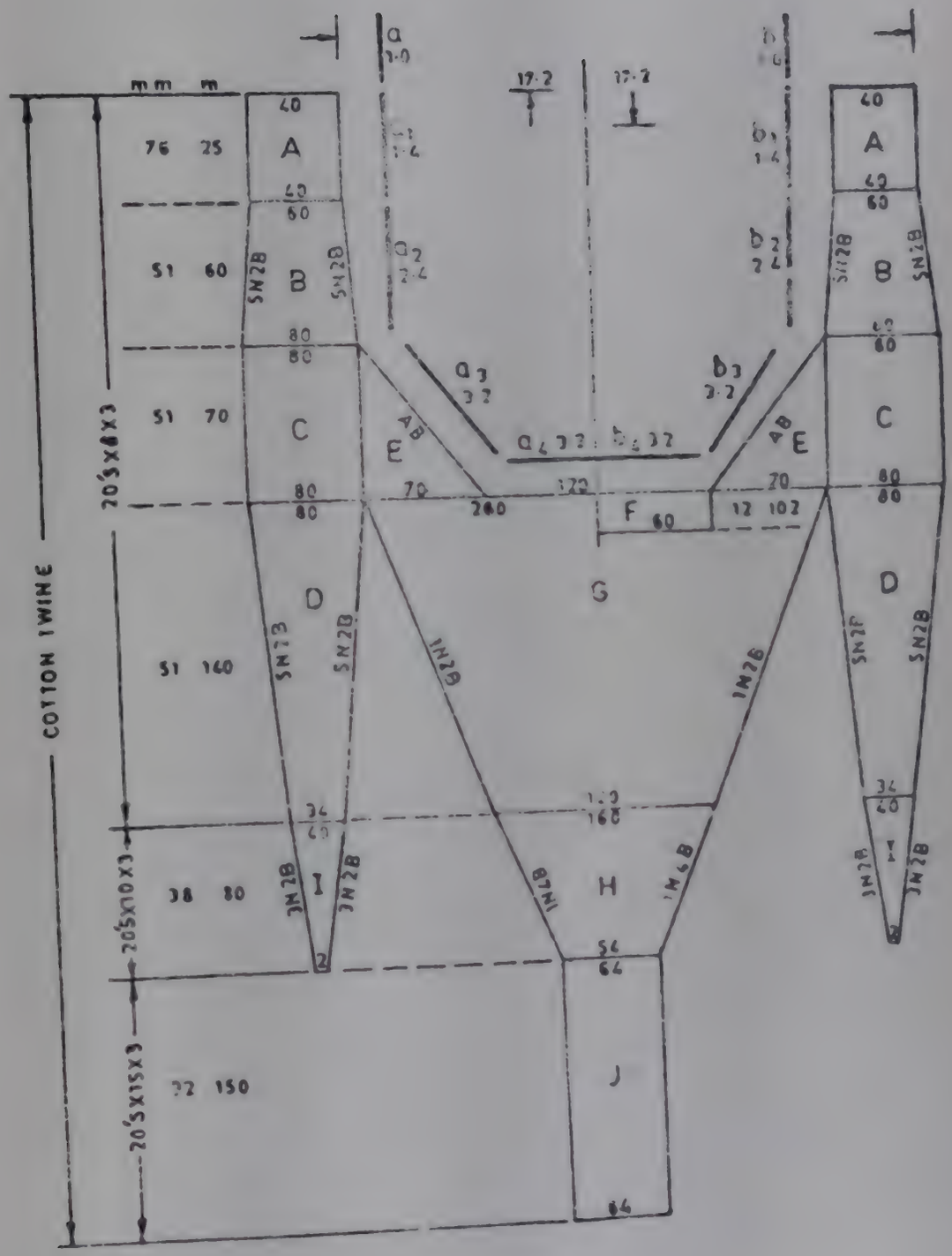
HEAD ROPE – 17·2 m

FOOT [illegible] – 17·2 m

[illegible] LINE – COTTON ROPE 5mm ø

COST PARTICULARS SEE APPENDIX NO. II

# 17m FOUR SEAM SHRIMP TRAWL NET.



# FIG. 17 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 11 28-13·70
G.R.T. : 12·8 - 15
H.P. : 56 - 60
TRAWLING SPEED : 2 - 3·5 KNOTS
CREW : 6-7

OTTER BOARD . RECTANGULAR, 55 - 60 Kg
PLACE OF OPERATION | WEST COAST OF INDIA
TYPES OF FISH CAUGHT |

| WEBBING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | COTTON TWINE 20 S x 9 x 3 | | | | | | 15 x 3 & 20 S x 20 x 3 | | — |
| TYPE OF KNOT | — | — | — | — | SINGLE SHEET BEND | — | — | — | — | — |
| PRESERVATION | — | — | — | — | CUTCH | — | — | — | — | — |
| COLOUR | — | — | — | — | DARK | — | — | — | — | — |
| TWINE SIZE ø | — | — | 1·2 mm | — | — | — | — | 1·3 mm | — | 2 mm |
| BREAKING STRENGTH | — | — | 1·2 | — | — | — | — | 16 | — | 22·6 |
| TWINE SURFACE AREA $m^2$ | — | — | — | — | 20·31 | — | — | — | — | — |
| STRETCHED MESH mm | 78 | 81 | [illegible] | [illegible] | [illegible] | 160 | 81 | 38 | 38 | 32 |
| UPPER EDGE m. | 40 | 60 | 80 | [illegible] | [illegible] | 80 | 280 | 150 | 50 | 80 |
| LOWER EDGE m. | 40 | 80 | 80 | 40 | 80 | 80 | 120 | 70 | 4 | 80 |
| DEPTH m. | 20 | 50 | 80 | 160 | 80 | 12 | 160 | 80 | 80 | 160 |
| BAITING RATE (Knife cutter) | NIL | 1/3 1:6 | NIL | 1:8 | 1:1 | NIL | 1:8 | 1:2 | 1:3·5 | NIL |
| TAKE UP | A 1/5 3/5 | B 1/5 1/1 | C 1/5 1/5 | D 4/5 1/5 | E 1/5 1/1 | F 1/5 1/2 | G 4/5 4/5 | H 2/5 3/8 | | |
| QUANTITY Kg. | | | | | | | | | | |
| HANGING | A1 = 0·70 | B1 = 0·78 | | | C1 = 0·88 | D1 = 0·57 | E1 = 0·52 | | | |

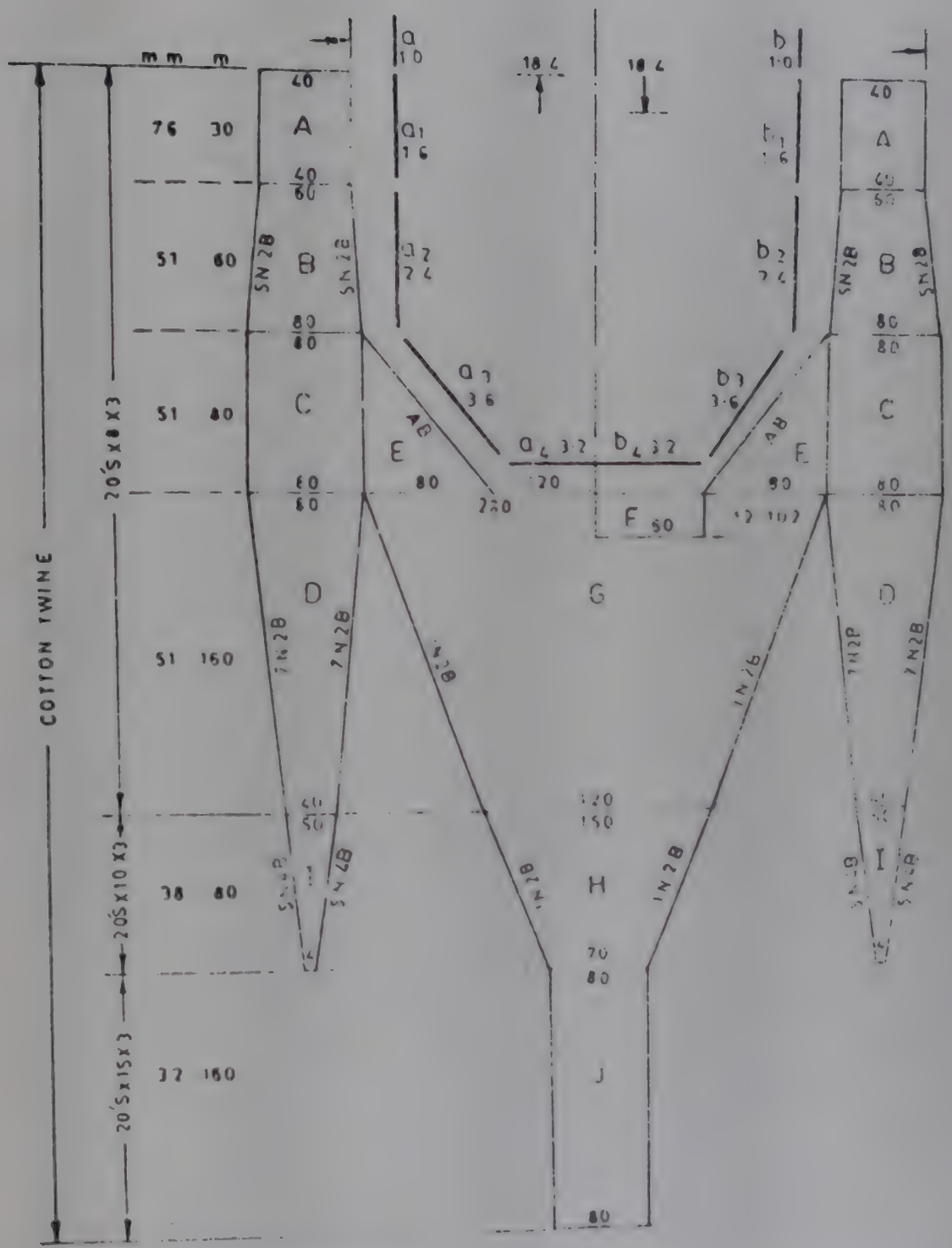
| LINES, ROPES | G | $G_1$ | $G_2$ | $G_3$ | $G_4$ | b | $b_1$ | $b_2$ | $b_3$ | $b_4$ |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | — | — | MANILA ROPE | — | — | — | — | — |
| CONSTRUCTION | — | — | — | CABLE LAID ( TOTAL 9 STRANDS ) | — | — | — | — | — | — |
| DIAMETER mm | — | — | 18 | — | — | — | — | 24 | — | — |
| BREAKING STRENGTH | — | — | 1600 | — | — | — | — | 2500 | — | — |
| LENGTH m | 1·0 | 1·8 | 2·4 | 3·6 | 3·2 | 1·0 | 1·6 | 2·4 | 3·6 | 3·2 |

| FLOATS, SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm | 127 | |
| MATERIAL | Al. | LEAD |
| NUMBER | 18 - 19 | |
| SHAPE | ○ | ⬭ |
| LENGTH m | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 23-25 |
| WEIGHT SUBMERGED Kg. | | |

HEAD ROPE :- 18·4 m.
FOOT ROPE :- 18·4 m.
BOLCH LINE :- COTTON ROPE 5 mm. ø

COST PARTICULARS SEE APPENDIX NO. 12

# 18m FOUR SEAM SHRIMP TRAWL NET



# FIG 18 DATA AND CONSTRUCTION DRAWING OF

VESSELS 17.5 m. oal.

G.R.T. 56.8

H.P 210

TRAWLING SPEED 2.5 KNOTS

CREW : 10

OTTER BOARD RECTANGULAR, 120 Kg. OR OVAL 150 Kg.

PLACE OF OPERATION | EAST COAST AND WEST COAST OF INDIA

TYPES OF FISH CAUGHT |

| WEBBING | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | PP OR PE | | | | | | | |
| TYPE OF KNOT | — | | | SINGLE SHEET BEND | | | | | |
| PRESERVATION | — | | | | NIL | | | | |
| COLOUR | — | | | | BLUE | | | | |
| TWINE SIZE Ø | — | | | 1.5 mm | | | | | 2.5mm |
| BREAKING STRENGTH | — | | | | 24 | | | | 63 |
| TWINE SURFACE AREA $m^2$ | — | | | | 45.95 | | | | |
| STRETCHED MESH mm | 64 | 51 | 51 | 51 | 38 | 51 | 51 | 38 | 32 |
| UPPER EDGE m | 60 | 81 | 112 | 112 | 70 | 1 | 375 | 210 | 100 |
| LOWER EDGE m | 60 | 112 | 112 | 56 | 10 | 112 | 163 | 90 | 100 |
| DEPTH m | 30 | 175 | 112 | 212 | 120 | 112 | 212 | 120 | 180 |
| BAITING RATE inner / outer | NIL | 1·2 / NIL | NIL | 1 7 5 | 1 4 | 1 1 / NIL | 1 2 | 1 2 | NIL |
| TAKE UP | $\frac{A}{B}=\frac{3}{4}$ | $\frac{B}{C}\ \frac{1}{1}$ | $\frac{C}{D}=\frac{1}{1}$ | $\frac{D}{E}=\frac{4}{5}$ | | $\frac{F}{G}=\frac{1}{1}$ | $\frac{G}{H}=\frac{3}{4}$ | $\frac{H}{I}=\frac{9}{10}$ | |
| QUANTITY Kg | | | | | | | | | |
| HANGING | $\frac{a1}{A}=0.94$ | $\frac{a2}{B}=0.74$ | | | | $\frac{a3}{F}=0.79$ | $\frac{a4}{G}=0.59$ | | |

| LINES, ROPES | a | a1 | a2 | a3 | a4 | b | b1 | b2 | b3 | b4 |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | | GALVANISED FLEXIBLE STEEL WIRE ROPE | | | | | | | |
| CONSTRUCTION | — | | | 6X19 WITH INNER FIBRE CORE | | | | | | |
| DIAMETER mm | — | | | | 9 | | | | | |
| BREAKING STRENGTH | — | | | | 160/mm² | | | | | |
| LENGTH m | 10 | 18 | 5.0 | 4.5 | 4.5 | 10 | 18 | 5.0 | 4.5 | 4.5 |

| FLOATS, SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 200 | 9 |
| MATERIAL | PLASTIC | G.I CHAIN |
| NUMBER | 9-10 | |
| SHAPE | —○— | |
| LENGTH m | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg | | 33-38 |
| WEIGHT SUBMERGED Kg | | |

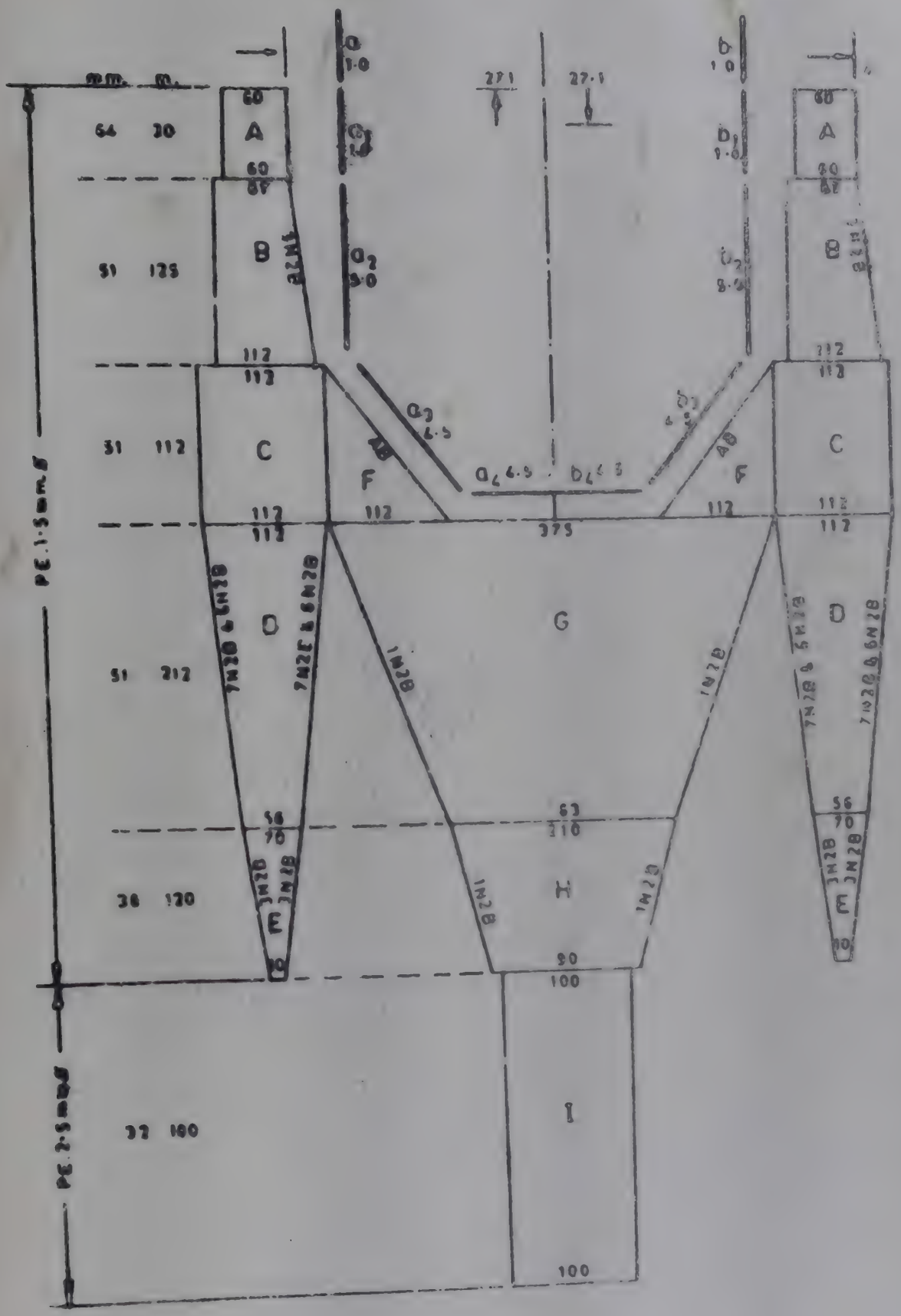
HEAD ROPE :-27.1 m

FOOT ROPE :-27.1 m.

BOLCH LINE :-PE 9 mm.Ø

COST PARTICULARS SEE APPEDIX NO.13

# 27m. FOUR SEAM SHRIMP TRAWL NET



# FIG 19 DATA AND CONSTRUCTION DRAWING OF

VESSELS 17·5 m.oal.
G.R.T 56·8
H.P 210
TRAWLING SPEED 2·5 KNOTS
CREW 10

OTTER BOARD : RECTANGULAR, 120 Kg. OR OVAL, 150 Kg.
PLACE OF OPERATION : EAST AND WEST COAST OF INDIA
TYPES OF FISH CAUGHT :

| WEBBING | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | PP OR PE. | | | | | | | | | |
| TYPE OF KNOT | SINGLE SHEET BEND | | | | | | | | | |
| PRESERVATION | NIL | | | | | | | | | |
| COLOUR | BLUE | | | | | | | | | |
| TWINE SIZE ⌀ | 1·5 mm | | | | | | | | | 2·5 mm |
| BREAKING STRENGTH | 24 | | | | | | | | | 63 |
| TWINE SURFACE AREA $m^2$ | 37 61 | | | | | | | | | |
| STRETCHED MESH mm. | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 40 | 36 |
| UPPER EDGE m. | 44 | 74 | 74 | 1 | 440 | 1 | 60 | 360 | 90 | 100 |
| LOWER EDGE m. | 74 | 74 | 6 | 120 | 80 | 60 | 80 | 80 | 90 | 100 |
| DEPTH m. | 150 | 120 | 340 | 120 | 270 | 60 | 60 | 210 | 80 | 160 |
| BAITING RATE inner / outer | 1 1 | NIL | 1 1 | 1 1 | 1 1 / 1 1·5 | 1 1 | 1 1 / 1 1·5 | 1 1·5 | NIL | NIL |
| TAKE UP | $\frac{A}{B}=\frac{1}{1}$ | $\frac{B}{C}=\frac{1}{1}$ | | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{I}=\frac{8}{9}$ | | | $\frac{H}{I}=\frac{8}{9}$ | $\frac{I}{J}=\frac{9}{10}$ | |
| QUANTITY Kg. | | | | | | | | | | |
| HANGING | $\frac{a_1}{A}=0.71$ | $\frac{b_1}{A}=0.71$ | $\frac{b_2}{B}=0.73$ | $\frac{a_2}{D}=0.92$ | $\frac{a_3}{E}=0.6$ | | $\frac{b_3}{FC}=0.92$ | | $\frac{b_4}{H}=0.65$ | |

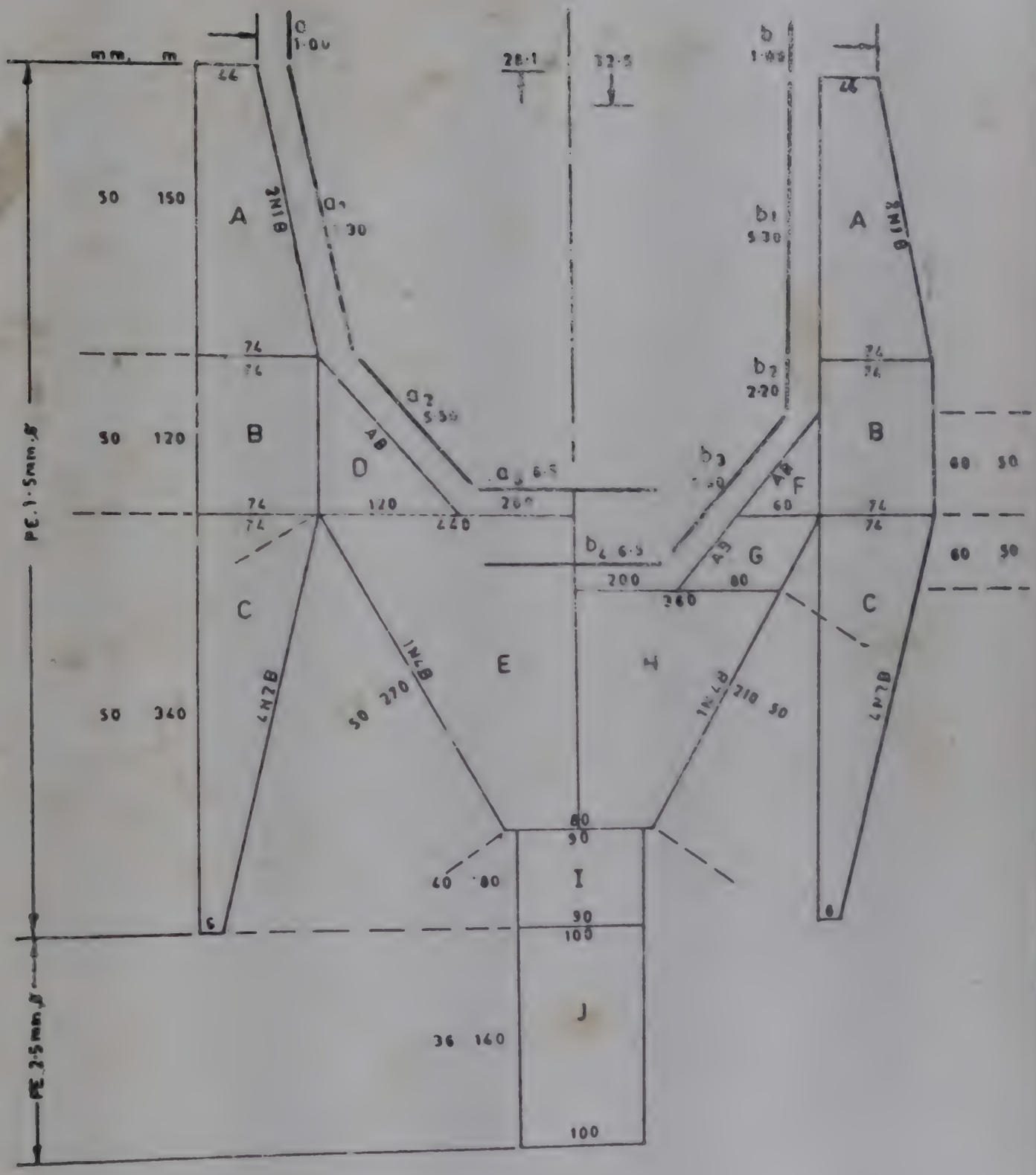
| LINES, ROPES | a | $a_1$ | $a_2$ | $a_3$ | b | $b_1$ | $b_2$ | $b_3$ | $b_4$ |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | GALVANISED FLEXIBLE STEEL WIRE ROPE | | | | | | | | |
| CONSTRUCTION | 6X19 WITH INNER FIBRE CORE | | | | | | | | |
| DIAMETER mm | 9 | | | | | | | | |
| BREAKING STRENGTH | 160/$mm^2$ | | | | | | | | |
| LENGTH m | 1·0 | 5·3 | 5·5 | 6·5 | 1·0 | 5·3 | 2·2 | 5·5 | 6·5 |

| FLOATS, SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 200 | 9 |
| MATERIAL | PLASTIC | G.I CHAIN |
| NUMBER | 11-12 | |
| SHAPE | —○— |  |
| LENGTH m | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 45-50 |
| WEIGHT SUBMERGED Kg. | | |

HEAD ROPE - 28·1 m.
FOOT ROPE - 32·5 m
BOLCH LINE - PE 6 mm ⌀

COST PARTICULARS SEE APPENDIX NO. 14

# 28m. FOUR SEAM SHRIMP TRAWL NET.



# FIG 20 DATA AND CONSTRUCTION DRAWING OF

VESSELS : 32.28 m oal
G.R.T. : 182.6
H.P. : 578
TRAWLING SPEED : 3 KNOT
CREW : 16

OTTER BOARD | RECTANGULAR 375 Kg.
PLACE OF OPERATION | UPPER EAST COST OF INDIA
TYPES OF FISH CAUGHT |

| WEBBING | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | — | — | PP OR PE | — | — | — | — |
| TYPE OF KNOT | — | — | — | — | SINGLE SHEET BEND | — | — | — | — |
| PRESERVATION | — | — | — | — | — | NIL | — | — | — |
| COLOUR | — | — | — | — | — | BLUE | — | — | — |
| TWINE SIZE ø | — | — | — | — | 2 mm | — | — | — | — |
| BREAKING STRENGTH | — | — | — | — | 36 | — | — | — | — |
| TWINE SURFACE AREA $m^2$ | | | | | | | | | |
| STRETCHED MESH mm. | — | — | — | 50 | — | — | — | 42 | 38 |
| UPPER EDGE m. | 56 | 100 | 100 | 1 | 492 | 1 | 400 | 120 | 135 |
| LOWER EDGE m. | 100 | 100 | 26 | 136 | 100 | 90 | 100 | 120 | 135 |
| DEPTH m | 340 | 136 | 294 | 136 | 294 | 136 | 226 | 150 | 195 |
| BAITING RATE inner / outer | 1 : 10 | NIL | 1 : 4 | 1 : 1 | 1 : 2 | 1 : 1 | 1 : 2 | NIL | NIL |
| TAKE UP | $\frac{A}{B}=\frac{1}{1}$ | $\frac{B}{C}=\frac{1}{1}$ | | $\frac{D}{E}=\frac{1}{1}$ | $\frac{E}{H}=\frac{5}{5}$ | $\frac{F}{G}=\frac{1}{1}$ | $\frac{G}{A}=\frac{5}{5}$ | $\frac{H}{I}=\frac{8}{9}$ | |
| QUANTITY Kg. | | | | | | | | | |
| HANGING | $\frac{a_1}{A}=0.71$ | $\frac{b_1}{A}=0.71$ | $\frac{b_2}{B}=0.76$ | $\frac{a_2}{D}=0.91$ | $\frac{a_3}{E}=0.65$ | $\frac{b_3}{F}=0.91$ | $\frac{b_4}{G}=0.65$ | | |

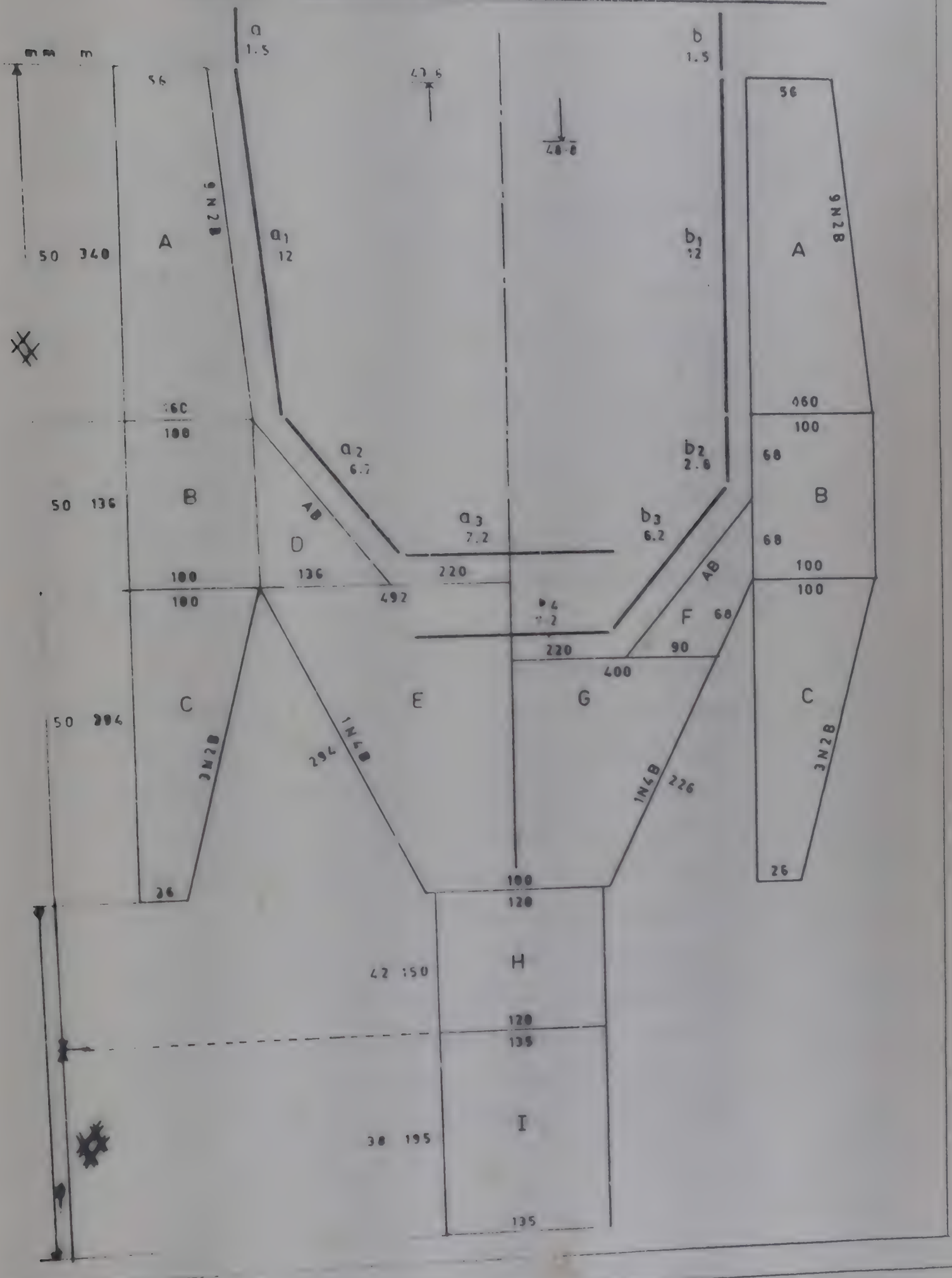
| LINES ROPES | a | $a_1$ | $a_2$ | $a_3$ | b | $b_1$ | $b_2$ | $b_3$ | $b_4$ |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | — | — | GALVANISED FLEXIBLE STEEL WIRE ROPE | — | — | — | — | — | — |
| CONSTRUCTION | — | — | 6 X 19 WITH INNER FIBRE CORE | — | — | — | — | — | — |
| DIAMETER mm. | — | 12 | — | — | — | — | 16 | — | — |
| BREAKING STRENGTH | | | | | | | | | |
| LENGTH m. | 1.5 | 12 | 6.2 | 7.2 | 1.5 | 12 | 2.6 | 6.2 | 7.2 |

| FLOATS, SINKERS | FLOATS | SINKERS |
|---|---|---|
| DIAMETER mm. | 200 | 9 |
| MATERIAL | Al & Pl | G.I.CHAIN |
| NUMBER | 18-19 | |
| SHAPE | —○— | |
| LENGTH m. | | |
| STATIC BUOYANCY | | |
| WEIGHT IN AIR Kg. | | 70-72 |
| WEIGHT SUBMERGED Kg. | | |

HEAD ROPE :- 43.6 m
FOOT ROPE :- 48.8 m
BOLCH LINE :- PP OR PE ROPE 6 mm ø

COST PARTICULARS : SEE APPENDIX NO. 15

# 43.6m FOUR SEAM SHRIMP TRAWL NET.

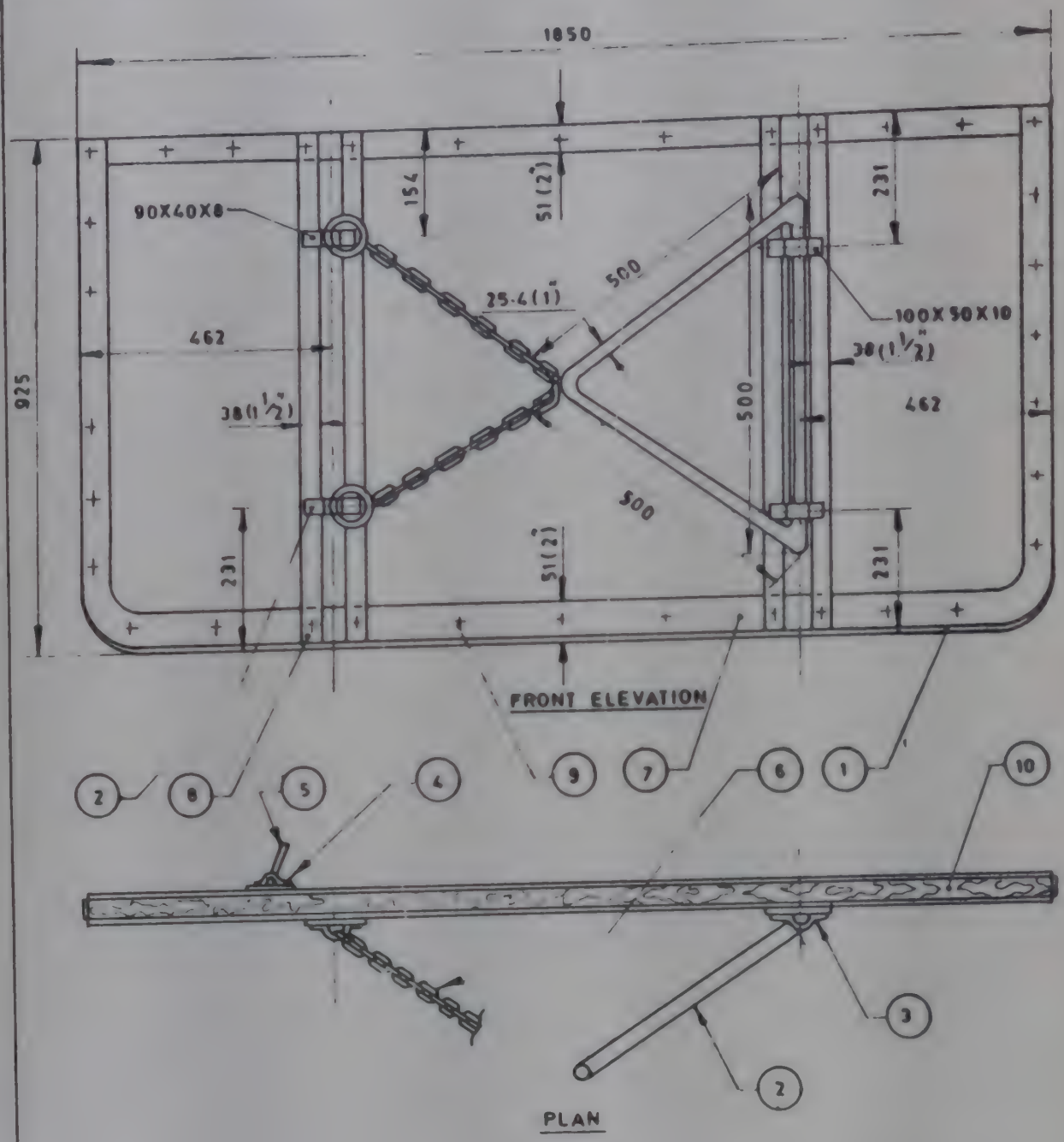


## 8. OTTER BOARDS

Among the trawl gear accessories otter boards are of prime importance and had an evolution parallel to that of the net itself. The experiments started in 1860's for an advanced device to maintain the spread of net required several years of experience for a general pattern to come out. The boards in its present form appeared first in Ireland in 1885 which again took many years of modification for satisfactory performance. It was in 1892 the first successful otter board trial was made in the English North sea coast. By 1895 France, Germany and Holland tried these boards and their success made them popular in all the world fisheries.

A conventional flat otter board (Fig. 21) is rectangular in shape and made of wood and steel. The length is approximately twice the height and surface area and weight are suited to Horse power of the vessel. Planks of wood are fitted into a frame made from steel and braced back and front with steel bars. A heavy steel keel is welded to the bottom edgeand the lower sides are protected from damage by steel side plates. Two triangular towing brackets, of which one is slightly smaller than the other, are hinged on front of the board. A pair of iron rings are bolted on the back in a

FIG-21




LEFT BOARD SHOWN MIRROR REFLCTION FOR RIGHT BOARD

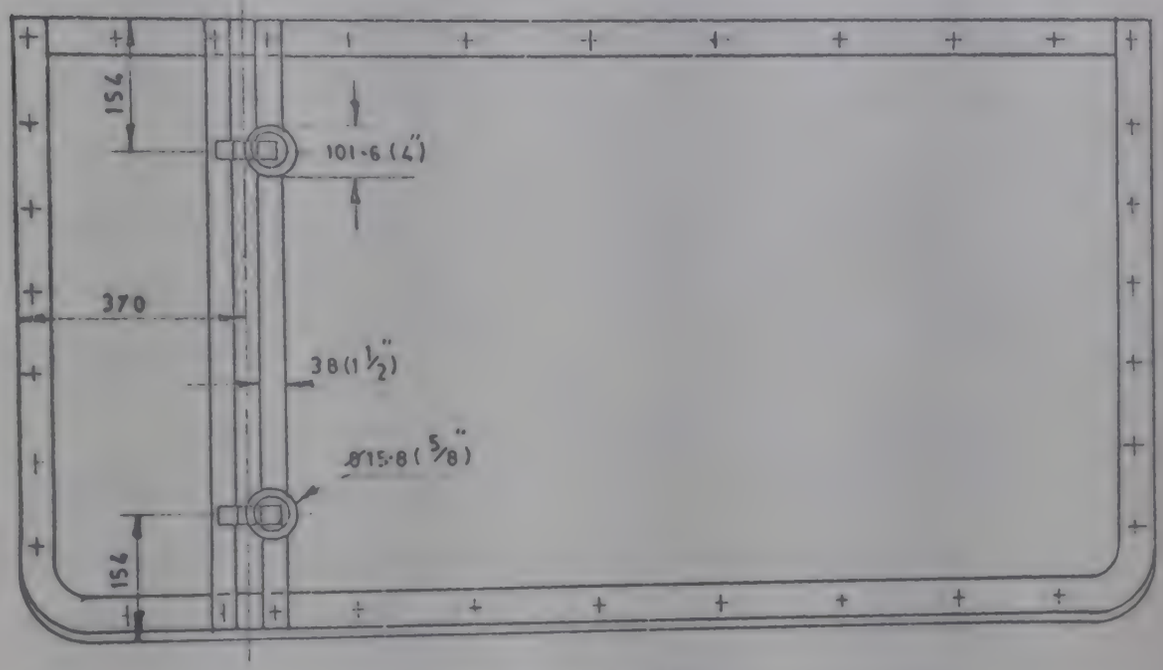
WEIGHT - 120 Kgs

AREA - 1.7 $m^2$

PROPULSION ENG. POWER 200 HP.

NOTE - ALL DIMENSIONS ARE IN MILIMETERS

NOT TO SCALE




BACK ELEVATION

# DETAILS

## RECTANGULAR FLAT OTTER BOARD -120Kg. (AREA-1·7m.²)

## USED IN COMBINATION WITH 28 m SHRIMP TRAWL

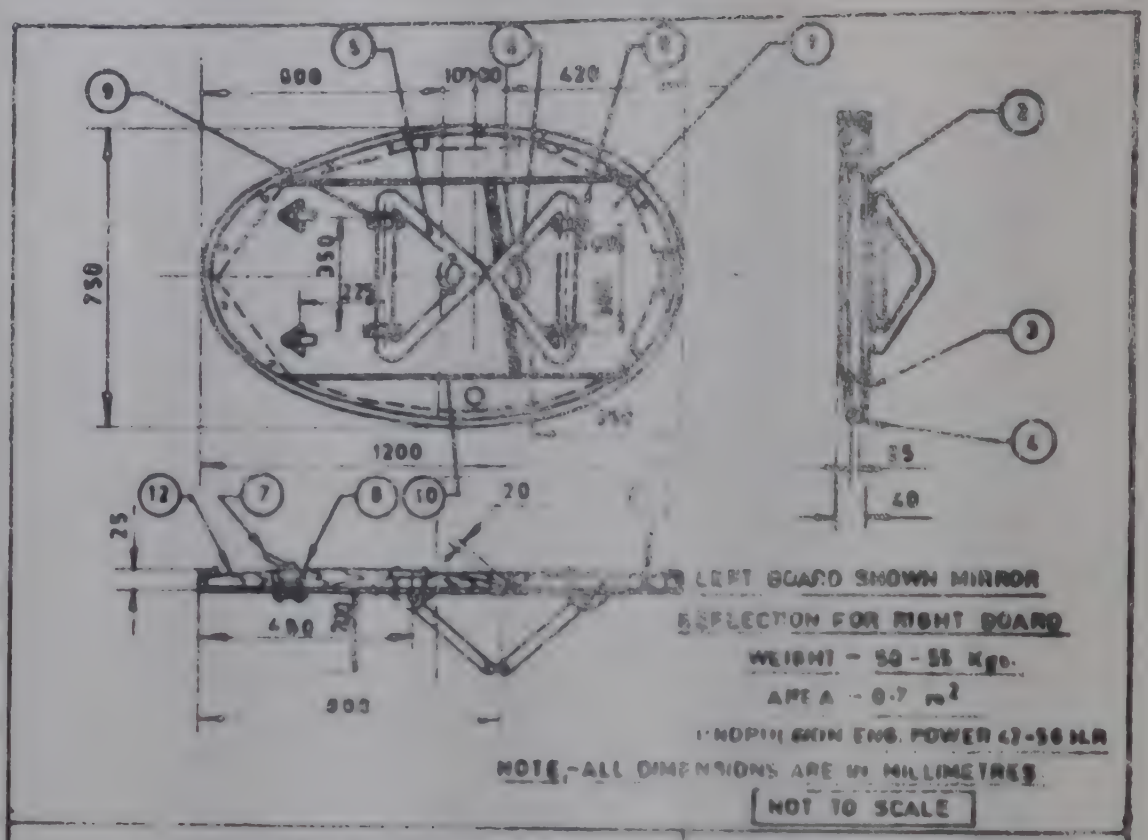
| SRL No. | No REQD | DESCRIPTION | MATL | REMARKS |
|---|---|---|---|---|
| 10 | - | PLANKS 38 (1½") THK | WOOD | |
| 9 | | BOLTS, Ø9·5 (⅜") | M.S. | |
| 8 | 3 | MIDDLE FLATS 9·5 (⅜") THK | M.S. | |
| 7 | - | BORDER FLATS 9·5 (⅜") THK | M.S. | |
| 6 | 1 | G.I. CHAIN, LINK Ø⅝" | M.S. | |
| 5 | 4 | RINGS | M.S. | |
| 4 | 4 | CLAMP (BACKSTROP & TRINNGLE) | M.S. | |
| 3 | 2 | CLAMPS (TRIANGLES) | M.S. | |
| 2 | 1 | TRIANGLE, 25·4 (1") DIA BAR | M.S. | |
| 1 | 1 | KEEL, 12·7 (½") THK | M.S. | |

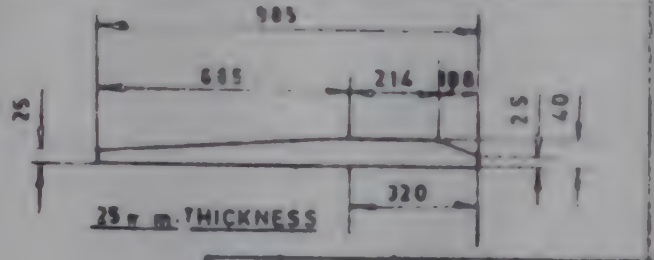
vertical line to which the backstrops are attached It has become a general practice to use chains instead of one or both the brackets which allow some adjustment to the rigging of the board. These brackets and backstrops are provided in such a way that when drawn through water the board, by its kite-like connection to the trawl warp, diverts at an angle most suitable for maintenance of spread of the trawl.

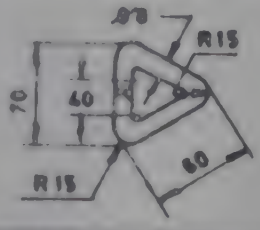
In the beginning the boards were attached direct to the net, but since the introduction and successful use of Vigneron Dahl patent with its extended spreading wire bridles, the old type is very seldom used now. Fig. 26 illustrates some of the rigging patterns commonly adopted.

Over the years a number of suggestions have been made for improving the trawl boards and changes have been made in overall size, shape, general pattern and attachment to the warp. The basic idea was to shape the board in such a way that its shearing power becomes as great as possible, but that the resistance to towing is as little as possible. In recent years, diverse designs in shape have been successfully used and include oval, concave, 'V' shaped and the cambered type of which the oval pattern had been extensively tried by this Project (Fig. 22 to 25). The oval otter boards have many

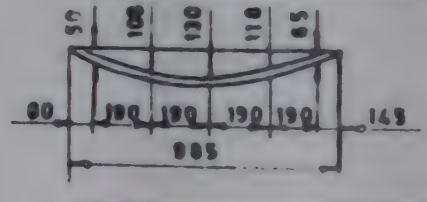
FIG:22



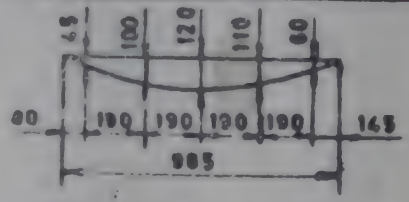



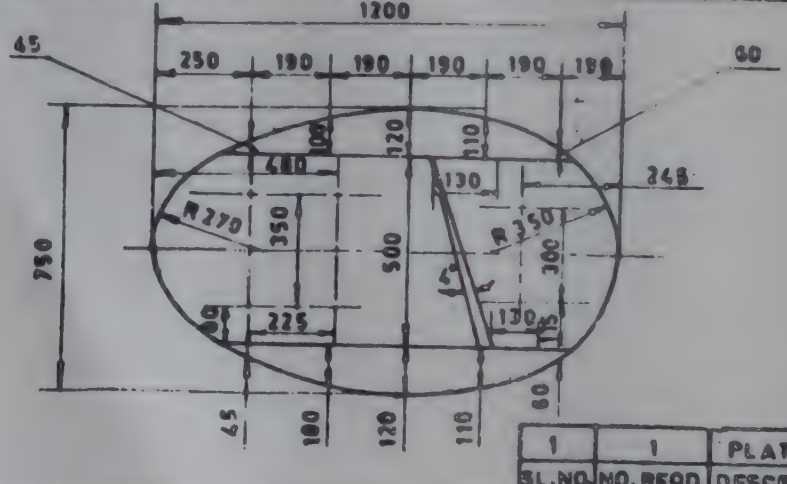

| 10 | 2 | STRINGERS | M.S. | 1 | 2 | RING | M.S. |
|---|---|---|---|---|---|---|---|
| SL.NO | NO REQD | DISCRIPTION | MATL | SL.NO | NO REQD | DESCRIPTION | MATL |



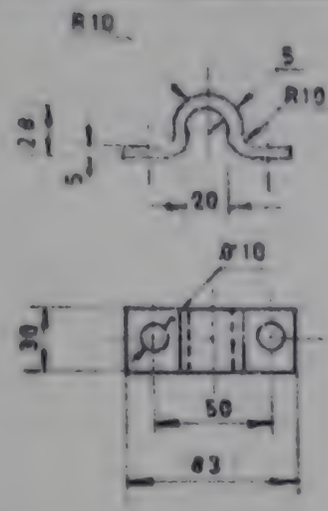

| 4 | 1 | KEEL | M.S |
|---|---|---|---|
| SL.NO | NO REQD | DESCRIPTION | MATL |



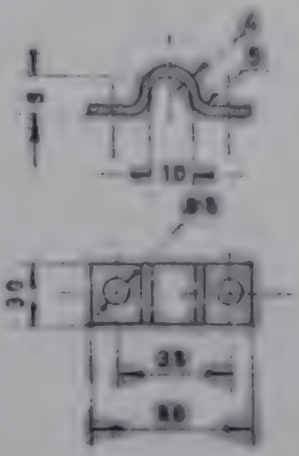

| 3 | 2 | PLATE | M.S. |
|---|---|---|---|
| SL.NO | NO REQD | DESCRIPTION | MATL |



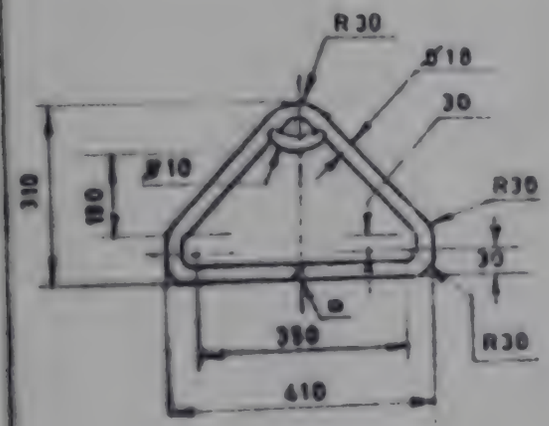

| 1 | 1 | PLATE | M.S. |
|---|---|---|---|
| SL.NO | NO. REQD | DESCRIPTION | MATL |




| 9 | 4 | TRIANGLE CLAMP | M.S. |
|---|---|---|---|
| S.NO | NO. REQD | DESCRI-PTION | MATL |




| 8 | 2 | BACKSTROP CLAMP | M.S. |
|---|---|---|---|
| S.NO | NO REQD | DESCRI-PTION | MATL |




| 5 | 1 | SMALL TRIANGLE | M.S |
|---|---|---|---|
| S.NO | NO REQD | DESCRI-PTION | MATL |

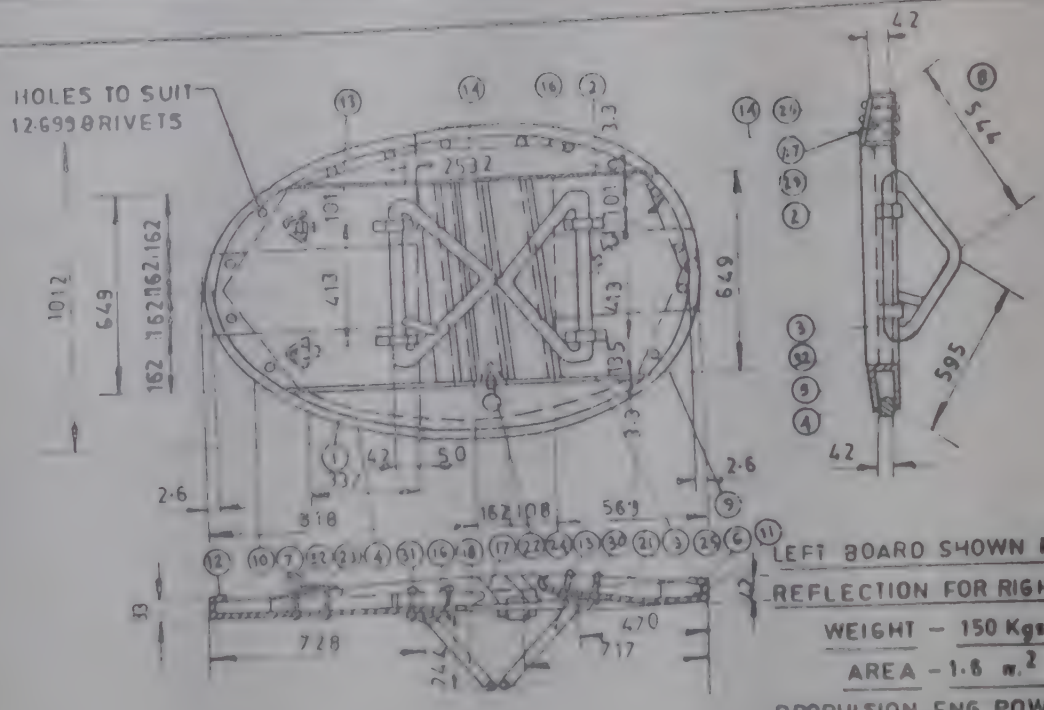

| 6 | 1 | BIG TRIANGLE | M.S. |
|---|---|---|---|
| S NO | NO REQD | DESCRI-PTION | MATL |

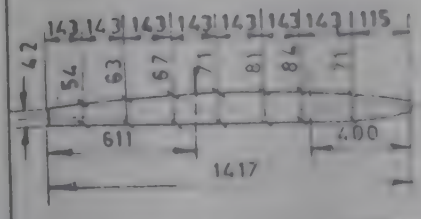
# DETAILS

## OVAL FLAT OTTER BOARD-50-55Kgs FOR 42HP TO 56 H.P. TRAWLERS

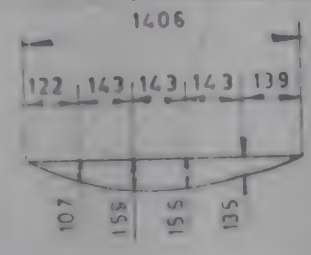
| SL. NO | NO REQD. | DESCRIPTION | MATL | REMARKS |
|---|---|---|---|---|
| 12 | 1 | STERN BOARD | WOOD | |
| 11 | 1 | FORE BOARD | WOOD | |
| 10 | 2 | STRINGERS | M.S. | |
| 9 | 4 | TRIANGLE CLAMP | M.S. | |
| 8 | 2 | BACKSTROP CLAMP | M.S. | |
| 7 | 2 | RINGS | M.S. | |
| 6 | 1 | BIG TRIANGLE | M.S. | |
| 5 | 1 | SMALL TRIANGLE | M.S. | |
| 4 | 1 | KEEL | M.S. | |
| 3 | 2 | KEEL SHEET | M.S. | |
| 2 | 2 | PLATE | M.S. | |
| 1 | 1 | PLATE | M.S. | |

FIG. 23

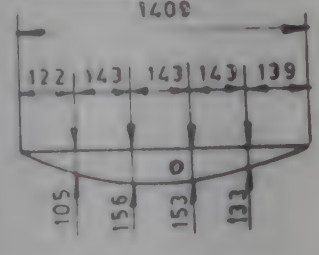


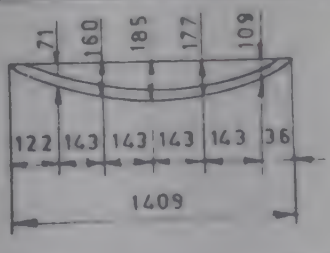

| 2&3 | 1 | STRINGERS | M.S. |
|---|---|---|---|
| SL.NO. | REQD | DESCRIPTION | MATL |



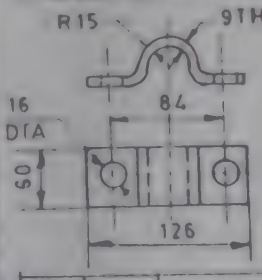

| 5 | 1 | KEEL SHEET | M S |
|---|---|---|---|
| SL NO | REQD | DESCRIPTION | MATL |



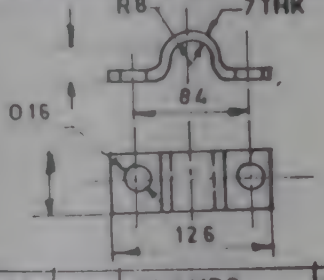

| 4 | 1 | KEEL SHEET | M.S. |
|---|---|---|---|
| SL.NO | REQD | DESCRIPTION | MATL |



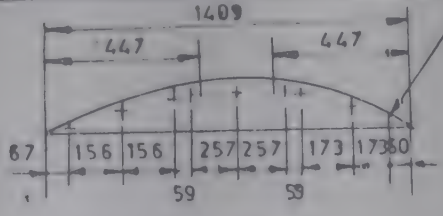

| 1 | 1 | KEEL | M S |
|---|---|---|---|
| SL.No | REQD | DESCRIPTION | MATL |

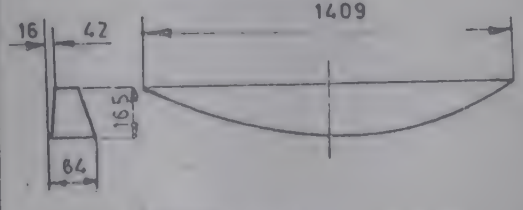



| 21 | 4 | CLAMPS | M.S. |
|---|---|---|---|
| SL No | REQD | DESCRIPTION | MATL |

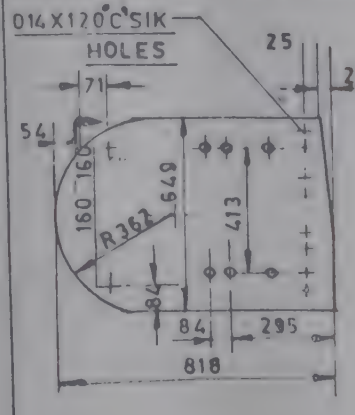


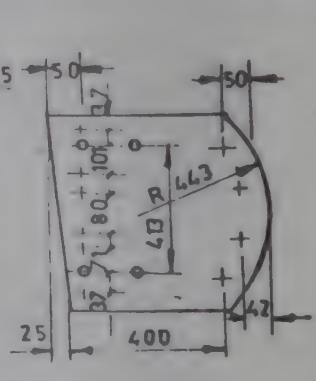

| 23 | 2 | CLAMPS | M.S. |
|---|---|---|---|
| SL.No | REQD | DESCRIPTION | MATL |



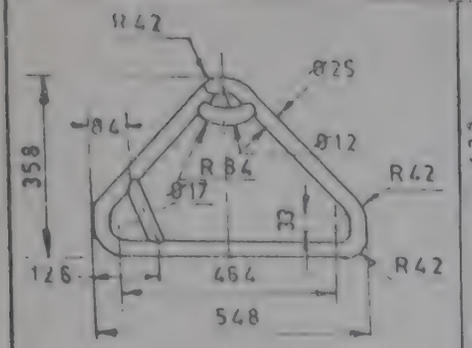




| 8&27 | 1 | SHEET & BOARD | M.S. |
|---|---|---|---|
| SL. No | REQD | DESCRIPTION | MATL. |

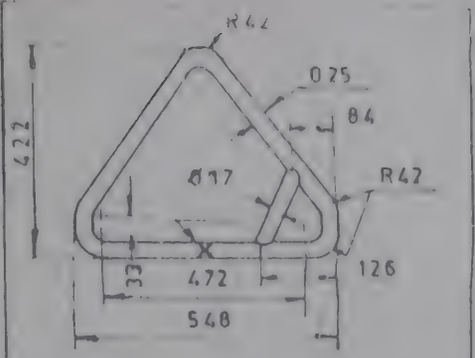


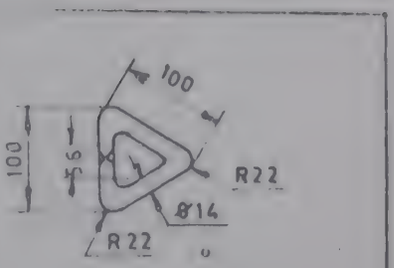

| 7 & 6 | 1 | STERN & FORE SHEET | M S |
|---|---|---|---|
| SL.No. | REQD. | DESCRPTION | MATL. |




| 19 | 1 | TRIANGLE | M.S. |
|---|---|---|---|
| SL.NO. | REQD. | DESCRIPTION | MATL. |




| 18 | 1 | TRIANGLE | M.S. |
|---|---|---|---|
| SL.NO. | REQD. | DESCRIPTION | MATL |



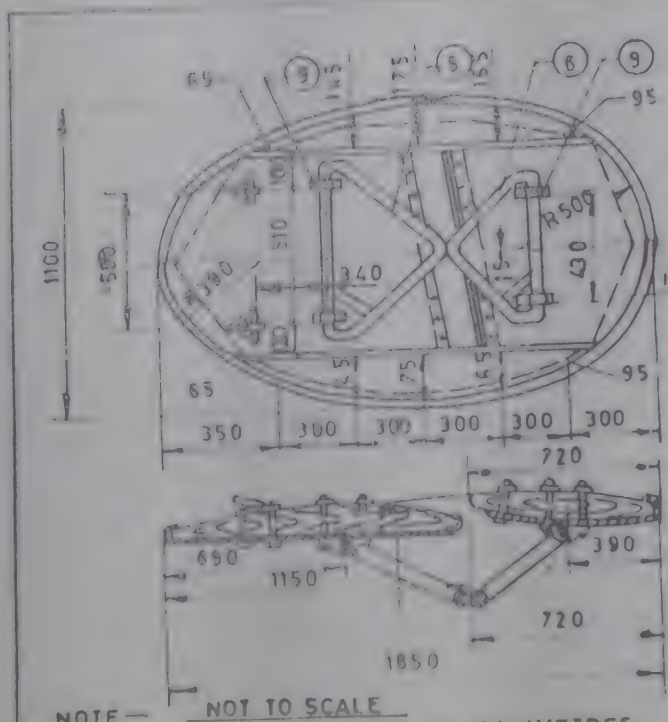

| 22 | 3 | RING | M.S. |
|---|---|---|---|
| SL.NO. | REQD. | DESCRIPTION | MATL. |

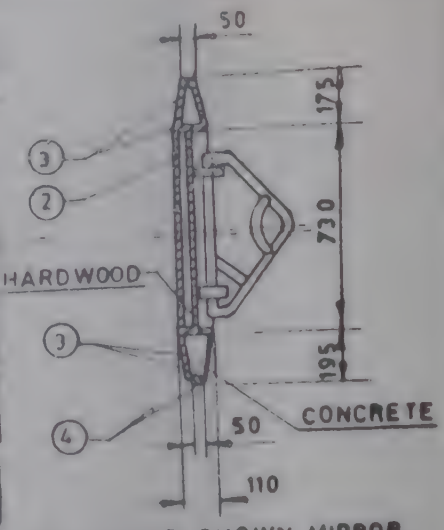
# DETAILS

## OVAL FLAT OTTER BOARD 150 Kgs. FOR 153 H.P. TO 200 H.P. TRAWLERS

| SL. NO. | NO. REQD. | DESCRIPTION | MATL | REMARKS |
|---|---|---|---|---|
| 32 | | CONCRETE | CONCRETE | |
| 31 | 4 | WASHER | M.S. | |
| 30 | 12 | BOLTS | M.S. | |
| 29 | 2 | WASHER | M.S. | |
| 28 | 31 | RIVETS | M.S. | |
| 27 | 1 | UPPER BOARD | WOOD | |
| 26 | 1 | STERN BOARD | WOOD | |
| 25 | 1 | FORE BOARD | WOOD | |
| 24 | 1 | LOOP | M.S. | |
| 23 | 2 | BACKSTROP CLAMPS | M.S. | |
| 22 | 3 | BACKSTROP AND LIFTING RING | M.S. | |
| 21 | 4 | TRIANGLE CLAMPS | M.S. | |
| | | | | |
| 19 | 1 | SMALL TRIANGLE | M.S. | |
| 18 | 1 | BIG TRIANGLE | M.S. | |
| 17 | 3 | WEDGE | M.S. | |
| 16 | 2 | FLAT BAR | M.S. | |
| 15 | 1 | PLATE | M.S. | |
| 14 | 1 | PLATE | M.S. | |
| 13 | 1 | PLATE | M.S. | |
| 12 | 2 | STERN PLATE | M.S. | |
| 11 | 2 | FORE PLATE | M.S. | |
| 10 | 2 | FLAT BAR STERN | M.S. | |
| 9 | 1 | FLAT BAR | M.S. | |
| 8 | 1 | UPPER SHEET | M.S. | |
| 7 | 1 | STERN SHEET | M.S. | |
| 6 | 1 | FORE SHEET | M.S. | |
| 5 | 1 | BACK KEEL SHEET | M.S. | |
| 4 | 1 | FRONT KEEL SHEET | M.S. | |
| 3 | 1 | LOWER STRINGER | M.S. | |
| 2 | 1 | UPPER STRINGER | M.S. | |
| 1 | 1 | KEEL | M.S. | |

FIG 24



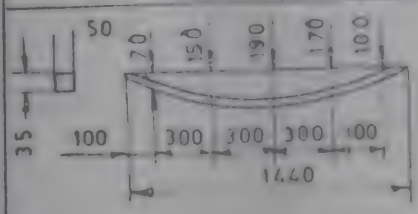

LEFT BOARD SHOWN MIRROR REFLECTION FOR RIGHT BOARD

WEIGHT - 180-190 Kg

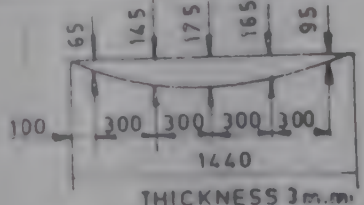
AREA - 1.60 m.²

PROPULSION ENG: POWER - 200 H.P

NOTE - NOT TO SCALE
ALL DIMENSIONS ARE IN MILLIMETRES

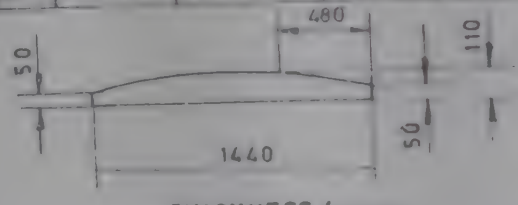



| SL.NO | REQD | DESCRIPTION | MATL |
|---|---|---|---|
| 4 | 1 | KEEL | M.S. |



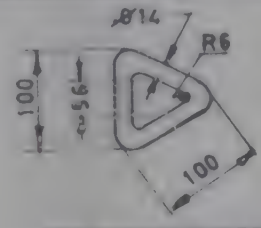

THICKNESS 3m.m.

| SL.NO | REQD | DESCRIPTION | MATL |
|---|---|---|---|
| 3 | 4 | SHEET | M.S. |

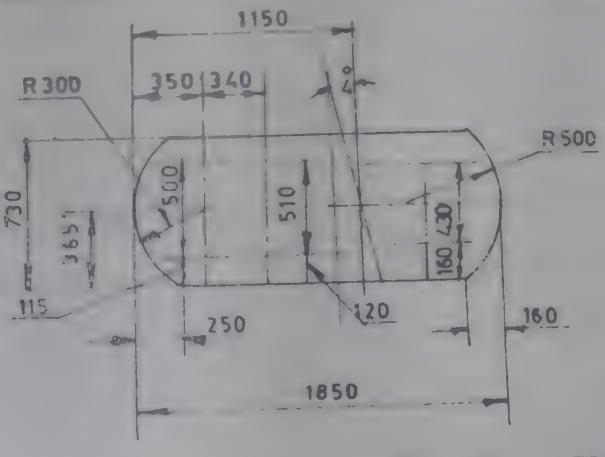



THICKNESS 4m.m.

| SL.NO | REQD | DESCRIPTION | MATL |
|---|---|---|---|
| 2 | 2 | STRINGER | M.S. |

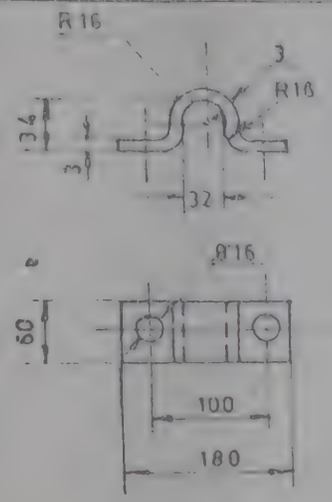



| SL.No | REQD | DESCRIPTION | MATL |
|---|---|---|---|
| ? | ? | BACKSTROP RING | M.S. |

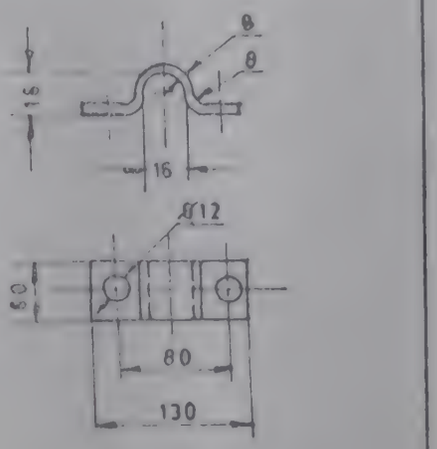



THICKNESS 3m.m.

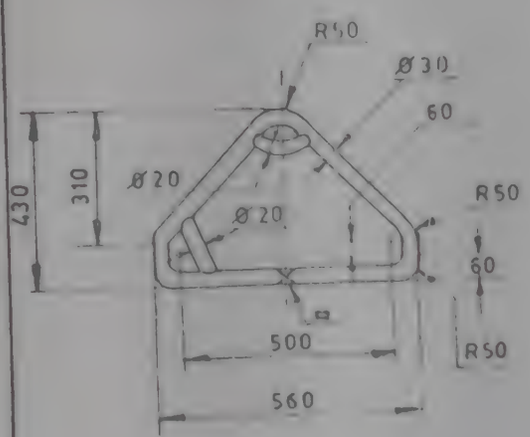
| SL.No | REQD | DESCRIPTION | MATL |
|---|---|---|---|
| 1 | 1 | STERN AND FORE SHEET | M.S. |



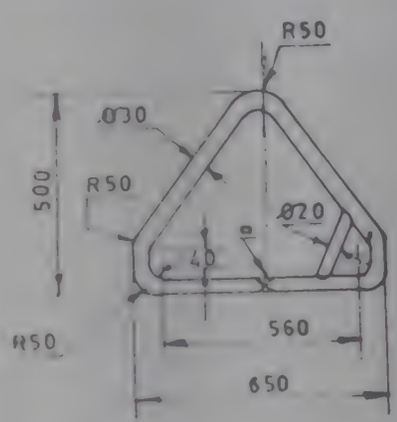

| SL. NO. | NO. REQD. | DESCRIPTION | MATL |
|---|---|---|---|
| 9 | 4 | TRIANGLE CLAMPS | M.S. |




| SL. NO. | NO REQD | DESCRIPTION | MATL |
|---|---|---|---|
| 8 | 2 | BACKSTROP CLAMPS | M.S. |




| SL. NO. | NO. REQD. | DESCRIPTION | MATL |
|---|---|---|---|
| 6 | 1 | SMALL TRIANGLE | M.S. |



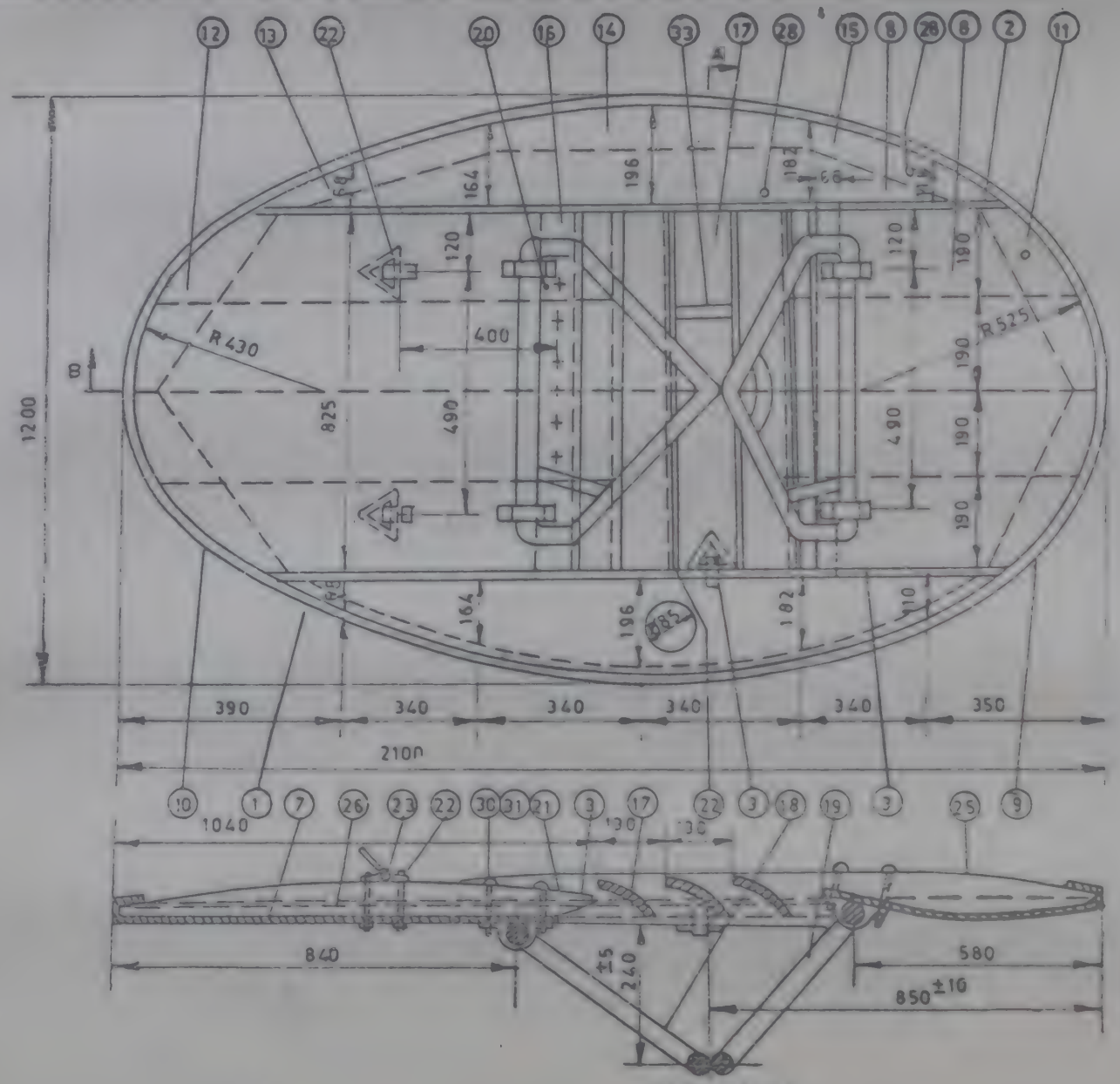

| SL NO. | NO. REQD. | DESCRIPTION | MATL |
|---|---|---|---|
| 5 | 1 | LARGE TRIANGLE | M.S. |

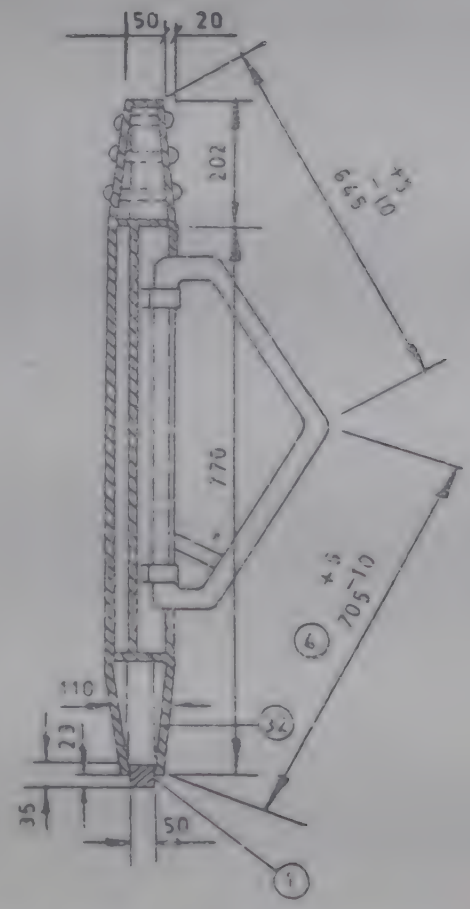
# DETAILS

## OVAL FLAT OTTER BOARD 180-190 Kg FOR 200 H.P. TRAWLERS.

| SL.NO. | NO.REQD | DESCRIPTION | MATL | REMARKS |
|---|---|---|---|---|
| 9 | 4 | TRIANGLE CLAMPS | M.S | |
| 8 | 2 | BACKSTROP CLAMP | M.S. | |
| 7 | 2 | BACKSTROP RING | M.S | |
| 6 | 1 | SMALL TRIANGLE | M.S. | |
| 5 | 1 | LARGE TRIANGLE | M.S. | |
| 4 | 1 | KEEL | M.S. | |
| 3 | 4 | SHEET | M.S. | |
| 2 | 2 | STRINGER | M.S. | |
| 1 | 1 | STRNN & FORE SHEET | M.S. | |

FIG. 15




LEFT BOARD SHOWN MIRROR REFLECTION FOR RIGHT BOARD

WEIGHT - 250 Kgs

AREA - 2 m.²

PROPULSION ENG POWER 240-300 HP

NOTE - ALL DIMENSIONS ARE IN MILIMETRES

NOT TO SCALE

1) A) WHILE ASSEMBLING OTTER BOARD PAY SPECIAL ATTENTION TO THE CENTRE OF TRIANGLES IN PAIR STATE CENTRE MUST BE SITUATED OF FROM HEAD OF BOARD 850 m.m.

B) FROM FLATNESS OF BOARD 290 m.m.

C) FROM LOWER EDGE TO CENTRE 705 m m

D) FROM UPPER EDGE TO CENTRE 645 m m

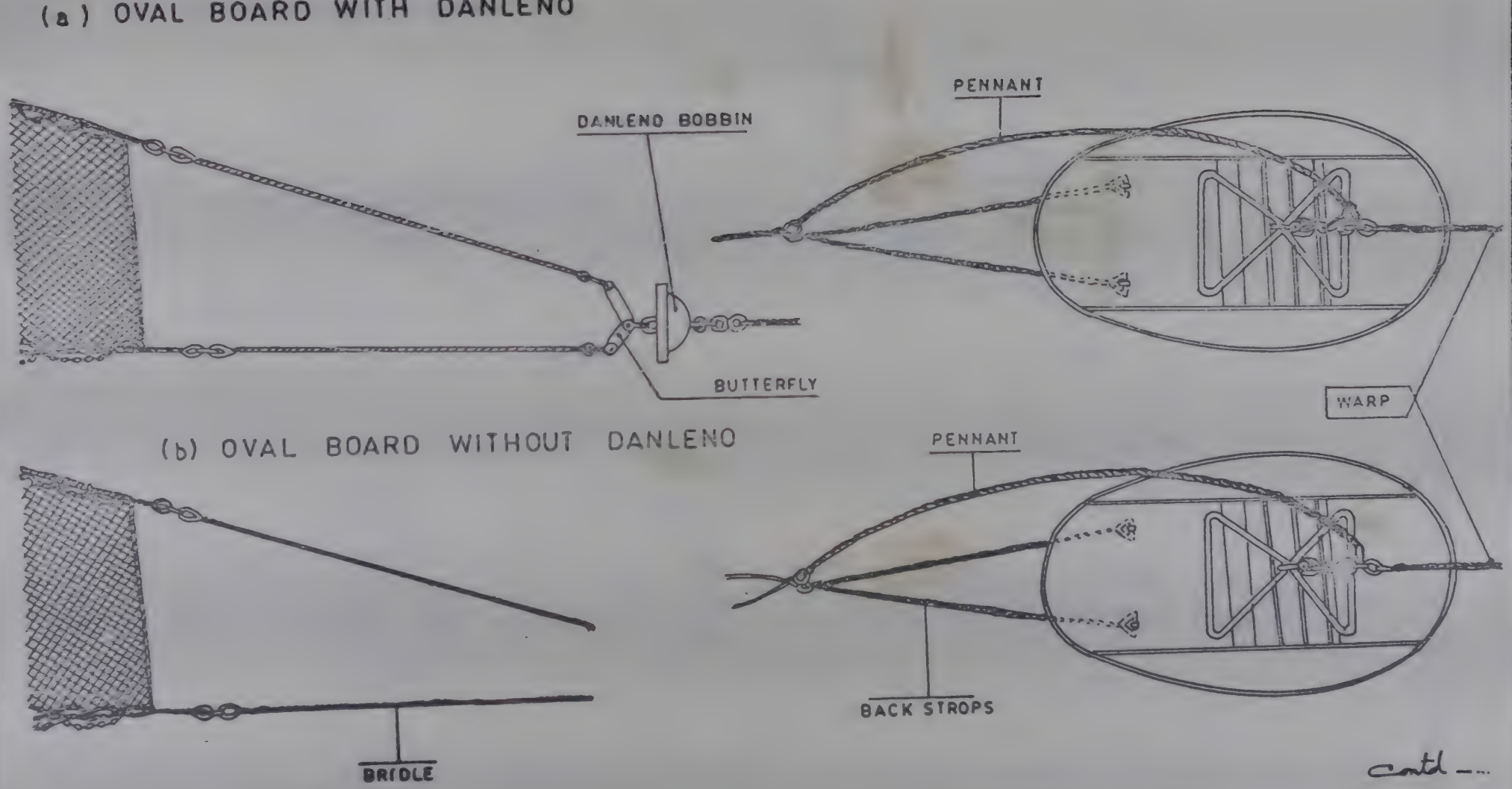
2) THIS STATE TO BE FIXED NEAR CLAMPS AFTER FIXING REMOVING OF TRIANGLES PROHIBITED BUT REMOVING THEM DOWN PERMITTED WITH IN THE LIMIT OF 10 mm.

# DETAILS

## OVAL FLAT OTTER BOARD 250 Kgs. FOR 240 H.P. TO 300 H.P. TRAWLERS.

| Sl. No. | No. REQD | DESCRIPTION | MATL. | REMARKS |
|---|---|---|---|---|
| 33 | 1 | ROD | M.S. | |
| 32 | | CONCRETE | CONCRETE | |
| 31 | 4 | WASHER | M.S. | |
| 30 | 12 | BOLT | M.S. | |
| 29 | 2 | WASHER | M.S. | |
| 28 | 31 | RIVETS | M/S | |
| 27 | 1 | WOOD PLANK | WOOD | WITHOUT SCHEME |
| 26 | 4 | PATTERN OF STERN BOARD | WOOD | |
| 25 | 4 | PATTERN OF FORE BOARD | WOOD | |
| 24 | 1 | LOOP | M.S. | |
| 23 | 2 | BACKSTROP CLAMPS | M.S. | |
| 22 | 3 | BACKSTROP AND LIFTING RING | M.S. | |
| 21 | 4 | TRIANGLE CLAMPS | M S | |
| 20 | 2 | LIMITER | M S | WITHOUT SCHEME |
| 19 | 1 | SMALL TRAINGLE | M.S. | |
| 18 | 1 | BIG TRIANGLE | M.S. | |
| 17 | 3 | WEDGE | M.S. | |
| 16 | 2 | PLANK | WOOD | |
| 15 | 1 | PLANK OF UPPER PLATING | WOOD | |
| 14 | 1 | PLANK FOR FORGED HEAD | WOOD | |
| 13 | 1 | PLANK OF UPPER PLATING | WOOD | |
| 12 | 2 | PLANK OF FORGED STERN | WOOD | |
| 11 | 2 | PLANK | WOOD | |
| 10 | 2 | STERN PLATING | M.S. | |
| 9 | 1 | PLATING | M.S. | WITHOUT SCHEME |
| 8 | 1 | UPPER SHEET | M.S. | |
| 7 | 1 | STERN SHEET | M.S. | |
| 6 | 1 | FORE SHEET | M.S | |
| 5 | 1 | BACK KEEL SHEET | M.S | |
| 4 | 1 | FORE KEEL SHEET | M.S. | |
| 3 | 1 | UPPER STRINGER | M.S. | |
| 2 | 1 | LOWER STRINGER | M.S. | |
| 1 | 1 | KEEL | M.S. | |

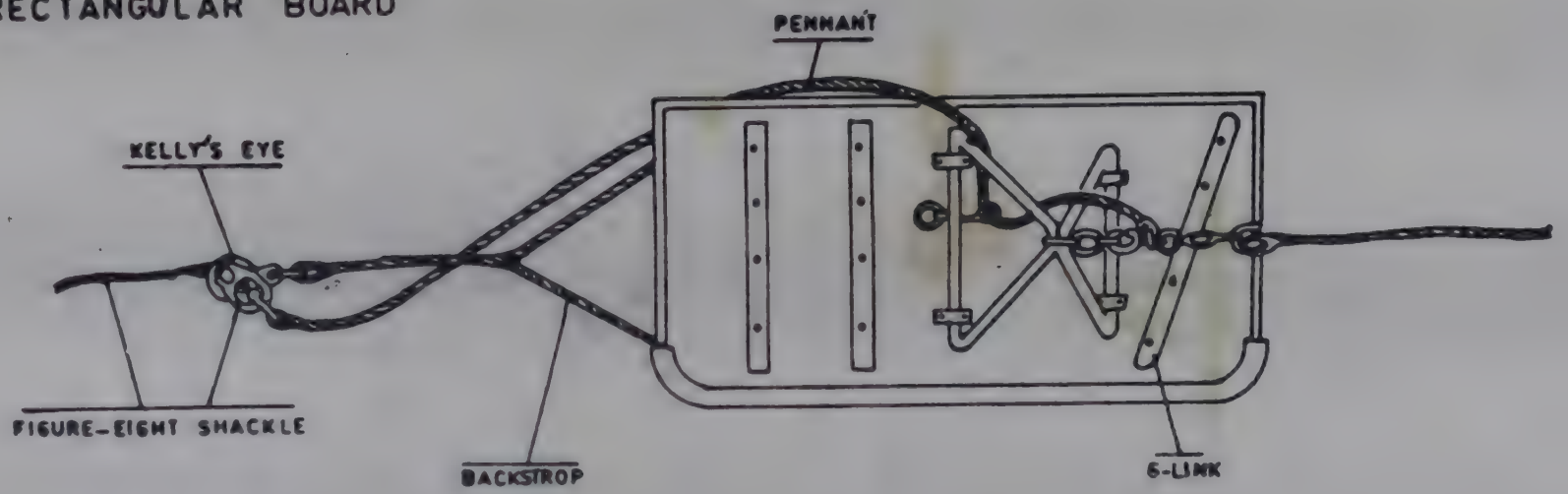
## FIG.26 SOME RIGGING PATTERNS

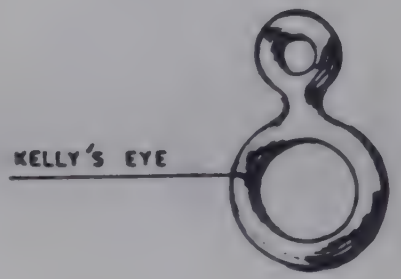


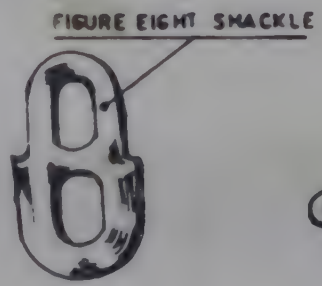

contd ....

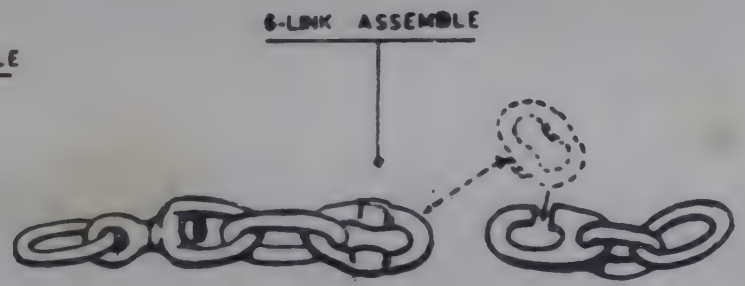
Contd

## (c) RECTANGULAR BOARD



advantages over the conventional type. They have less ground resistance, are less liable to foul on underwater obstruction. The slots, which may vary from one to four produce a smooth flow of water reducing resistance and turbulance. Moreover, it is claimed that they do give a greater spreading power for similar frontal area estimated for single slotted oval otter boards at approximately 19% (Garner, 1967).

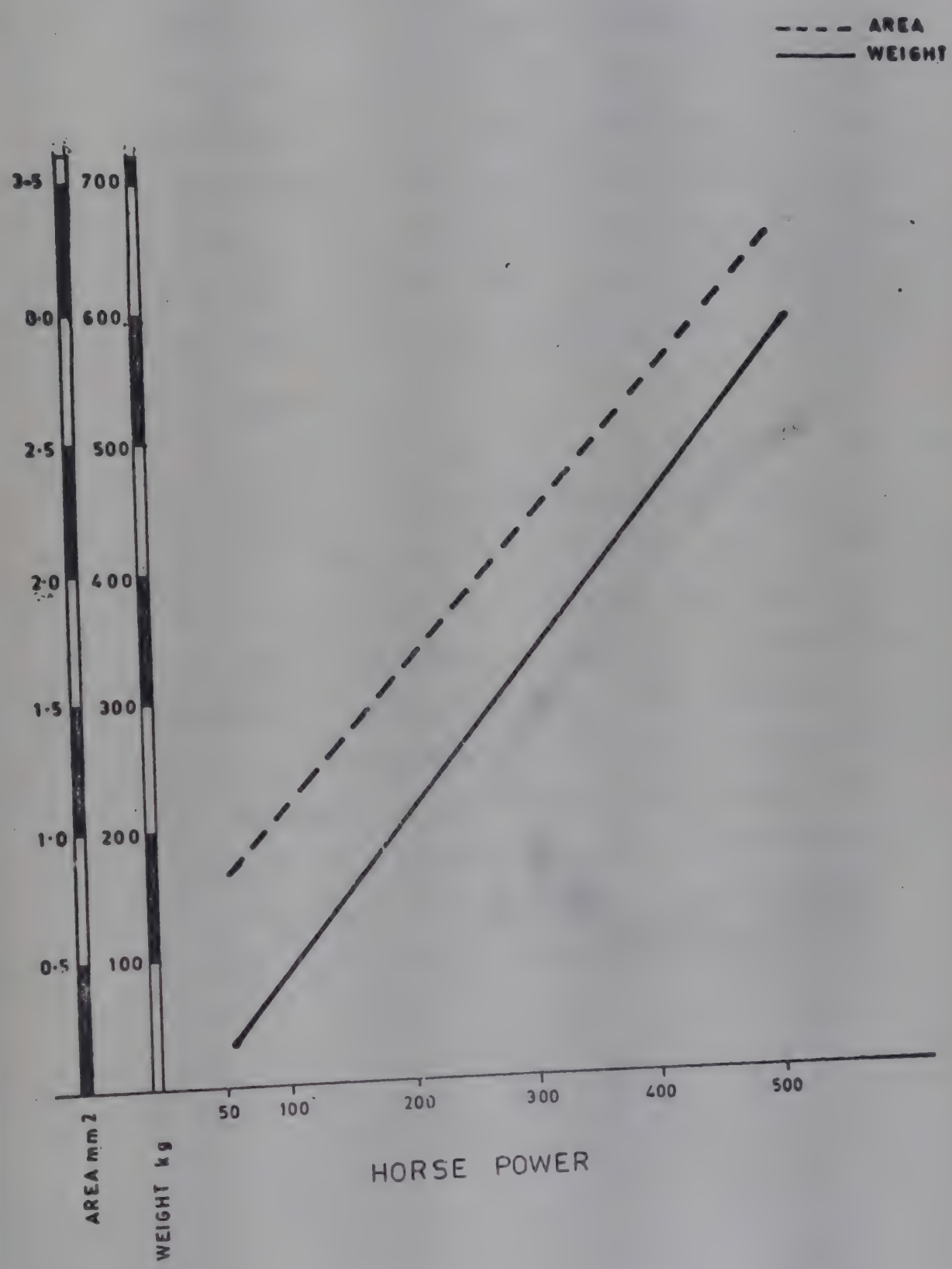
Otter board size and weight: There exists no definite principle about the relation between the size or propulsion power of the trawler and the size of otter boards. H.Miyamoto, ar FAO Gear Technologist collected information from Indian trawlers and a few Japnese vessels and found that the area of board is proportionate to the towing power of vessel. The relation between these two factors has been expressed by him as

$$S'' = 0.105\ P^{4/4}$$

Where S" is the area of the board and P is the Horse Power of engine (Miyamoto, 1959).

A graphical representation is projected in Fig. 27 giving guidelines in respect of area weight of otter boards for use of vessels of 50 to 500 HP (Garner, 1967). Variations may be necessary based on individual considerations depending on the area of operation and trawler specifications.

FIG.27 ESTIMATED ENGINE POWER RATIO TO AREA AND WEIGHT OF OTTER BOARDS FOR VESSELS OF 50 TO 500 H P



## 9. OTHER TRAWL ACCESSORIES

### 9.1. Floats

Floats are essential components of a fishing gear and these obviously are to help the gear to retain the required position under water maintaining the headline always upward. The main characteristics of float material are buoyancy, retnetion of buoyancy due to absorption of water, capacity to withstand different water pressures and resistance to rotting. Spherical floats of plastic material (PVC) and metallic (Aluminium) floats of different sizes are now increasingly being used instead of cork, thermocole and glass floats.

### 9.2. Sinkers

Where floats achieve the lifting of headline, sinkers are used for stretching the ground rope down so as to keep the trawl mouth open and the lower lip to touch the sea bed. Materials most commonly used are iron or pig iron in the form of chain and lead moulded in appropriate shape. The quantum of weight required for different trawls of varying dimensions are indicated in the relevant data sheets. But variations of minor degrees may become necessary depending on the difference in materials used, bottom conditions and depth of operation.

9.3. Pennants

A pennant or lazy line as it is often referred forms the connection between the figure-eight-shackle and connecting link of the warp (see Fig. 26). It is of galvanised steel wire of same thickness as the bridles and warps. The pennants, one with each otter-board, are used while the trawl net is being hauled up to take the strain of each sweep line and of the trawl, after the otter boards have been detached. There is no strain on these lines when the trawl is being towed.

9.4. Bridles

Bridles or sweeplines are the connecting wires linking the otter board and the leg of the net. In early trawl practices, this part was not in use and the boards were attached direct to the net. But a trawl equipped with bridles is estimated to have a greater spread than the former type. Length of bridles may vary from 10 to 20 meters and the diameter may be same as that of the warps.

9.5. Trawl warps

Trawl warps or the towing gear connect the functional gear to the trawler while in operation. They are wire ropes of identical length, two in number, fully would on the winch drum in idle position and are provided with a connecting link at the free end While shooting, the warp is connected to the otter board by means of G-Link assembly.

The diameter of the different wires used in trawling may vary (from 11 mm to 16 mm) depending on the size of vessel, its towing power and intensity of external forces like wave action, velocity of current etc. The rope must be flexible galvanised steel preferably of 6 x 19 construction with lubricated inner fibre core (6 strands x 19 wire twisted around fibre core).

9.6. Length of warp

The length of warp released while towing the gear is a very important factor principally because the otter boards are to be maintained in an upright position. Theoretically this is achieved at a depth/warp length ratio of 1:3 in 100 fathoms of water. Conditions vary of course, depending on tidal force, any other element such as sea bottom etc. But in shallow waters it is often necessary to tow the gear with more than the 1:3 warp ratio and the allowance may extend to 5 times the depth. The equation

$$F = \left(3 + \frac{25}{D}\right) D$$

(where F is the warp length and D, the depth of water) represents an approximate relation between the warp length and water depth (Miyamoto 1957). For controlling the length of the warps as they are paid out from the winch drums and for indicating, some phases of manoeuvring while shooting or hauling warp 'markers' are provided (by drawing cotton or synthetic rope of 4-6 mm dia through the strands of the rope) at every 25 metre intervals.

## 10 ADDITIONAL INFORMATION

### 10.1. What size gear to use

A clear rule has not been evolved so far on the relation between the size of the vessel or its engine power and the size of net to be used. Miyamoto in course of his investigations, principally among Indian trawlers found that the size of net used in practice can be related approximately to the power of engine in the following manner.

$$L = \sqrt{43.6\ P + 660}$$

Where L is the length of headline in feet and P the h.p. of engine (Miyamoto, 1959). This Project's experience is in confirmity with the above generalisation.

### 10.2. Bobbins protect the net

Rollers or bobbins made of wood, iron, rubber or other hard ware materials are designed to roll over the sea bed. Fastened to the ground rope of a trawl they safeguard the lower lip of the net when fishing over rocks and corals and rough and uneven grounds. They may be of various shapes, mainly round, disc or spherical.

10.3. Added advantage of tickler chain

Tickler chain, running from one end of the foot rope to the other and slightly smaller in length is sometimes used to stir up the sea bed in front of the trawl mouth, the disturbing action of which brings up the burrowing and sand and mud dwelling species. It is important in sole and shrimp fisheries.

10.4. Knotless webbing in trawl gear fabrication.

First introduced in Japan in 1922, knotless webbings are becoming very popular in many world fisheries and its commercial production started in India in 1964 which is progressively being used in different kinds of net fabrication. Knotless webbing is superior to the conventional type on account of the following reasons.

a. As there are no knots less twine is used to make the meshes which considerably reduces the bulk and weight of net.

b. As the fibres undergo practically no sharp bending, there is no reduction in strength and hence a comparatively lighter twine can be used.

c. Knotless webbing causes less friction in water and hence increases the towing speed.

d. Due to less friction handling is easy which saves time and labour.

e. The mesh size is maintained constant because there is no tightening of knots.

10.5. Preservation extends longevity of nets

If natural fibres are used in fabrication of the fishing gear, the net must be periodically treated with preservatives against rot and loss of strength. The action of preservatives are such that while some kill the bacteria the others make it physically impossible for the bacteria to attack the fibre. There is a wide range of preservatives in use such as copper sulphate, copper naphthenate, linseed oil, cutch, coal tar etc. of which the last two are recommended for trawl nets. The method adopted by this Project was cutch treatment the procedure of which is briefed below:

For cotton, the nets are first boiled for one or two hours, washed in fresh water and dried. They are then boiled with 3-4% solution of cutch in fresh water or sea water for 2 hours, then dried in sun or in shade. Upon drying the net is soaked once again in the same solution at room temperature for 12 hours.

While dyeing manila nets the same method can be employed, but heating should be avoided.

Impregnation with cutch and consecutive sun-drying builds up a thin film of tannic acid surrounding the fibres which prevents the infectious bacteria from entering in. But for a net in continuous use, this acid film will remain only for few weeks and so frequent redyeing will be required. To avoid this, a method has been evolved by application of fixatives such as sodium dichromate ($Na_2Cr_2O_7$) or potassium dichromate ($K_2Cr_2O_7$) which can double the life of the cutch treated materials. The process involves soaking of the net already treated with cutch as above, in 1% solution of $K_2Cr_2O_7$ or $Na_2Cr_2O_7$ at room temperature for one to two hours and then drying. The chemicals may be dissolved by heating, but the dyeing bath must not be heated (Takayama and Shimozaki, 1959).

## 11. CONCLUSION

It is hoped that a fairly wide range of information on bottom trawls furnished in this publication will enable users to select more efficient gears and adopt and perfect them wherever necessary to the fishing conditions usually encountered. In the changing situations it might become necessary to incorporate modifications of varying degrees to the existing patterns or to design altogether new models. While doing so, the aim should be to produce a net which will give the largest catching potential for the smallest cost in materials and the least energy output. Many different factors have to be taken into account such as resilience of webbing, strength and elasticity, resistance to flow of water, weight and bulk, speed of operation, cost of materials, conditions of fishing ground etc. It is also fundamental to find a method of determining objectively the most suitable elements of the fishing gear taking into account the behaviour of fish and the technical condition of operation. Again, while using different designs the relative efficiency and selectivity of the gear must be of prime consideration. By selectivity it is meant how much will a certain gear catch, what species and which size.

In its continuing efforts and from its accumulating experience, this project earnestly hopes to cast brighter light through its future publications to the intricacies involved in gear technology for bigger ocean fishing vessels and factory trawlers. Attempts will be made to derive clear pictures on the relative efficiency and selectivity of the specific gears.

## 12. GLOSSARY OF TECHNICAL TERMS USED IN FISHING GEAR TECHNOLOGY

A listing of the common technical terms used in fishing gear technology and fishing technology with appropriate explanatory note may be useful in a volume like this. It is not claimed that this compilation is complete. Synonym other than those given in the foregoing may also be in vogue. However all available compilations have been referred to in preparation of the foregoing.

| | |
|---|---|
| ASSEMBLING THE NET | Joining the different panels of webbing together and mounting with reinforcing ropes so as to form the net ready for use. See also "rigging". |
| ASSORTMENT | Bails of machine-made webbing having specific mesh size and dimensions. |
| BACKSTROP | A piece of wire rope with high breaking strength used for attaching the otter board with the sweep line and is partially responsible for determining the angle at which the board will tow. |

| | |
|---|---|
| BAR | One of the four sides of a mesh. Also called half mesh. |
| BAR CUT | Cutting only one leg at each knot. (See Fig. 2 a & 2 b) |
| BAR LENGTH | The length between two successive knots on a mesh usually used to denote the mesh size (in mm) |
| BELLY | The panel forming the main body part of the trawl net (see Fig.1) |
| BELLY LINE | The ropes running along the seams of the entire length of the trawl. The side meshes of the belly are seized to this rope. Syn. Belly rope |
| BOLCH LINE | A soft rope to which the webbings are hung and in turn attached to the working ropes viz. head rope and foot rope. |
| BOSOM | The centre portion of the trawl between the wings. |
| BRIDLE | Wire rope connecting the otter board to the net. |
| BUOY | A float with a conspicuous mark some- |

| | |
|---|---|
| | times carrying a flag or a lamp used to locate the presence of the gear or to identify a ground. In some countries radio-buoys are also in use. |
| BUOYANCY | Ability to float in water. Extra buoyancy means the capacity to float an appreciable mass along with the floating object. e.g., floats and buoys used on trawl nets. |
| BUTTER FLY | An iron bar with a wide angle attached along with the danleno to the trawl net for achieving vertical spread. |
| BATING | Reducing number of meshes in successive rows to achieve the conical shape of the panel in trawl nets. Achieved by employing different cycles of cutting. While fabricating the panel manually two meshes of the preceding rows are caught up in a single knot in the succeeding row. |
| BEAM TRAWL | Fore-runner of modern otter trawls which used a metallic or wooden beam to maintain the shape of the trawl mouth. |
| BRAIDING | Mending the net by hand. |

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|---|---|
| CODEND | The cylindrical end portion of the trawl net usually made of small meshes of thick double twine where the fish gets accumulated during trawling operation. |
| CODLINE | A rope with high breaking strength threaded through the meshes of the lower periphery of the codend so as to close the codend. |
| COMBINATION ROPE | Rope made of natural or synthetic fibres with the strands having reinforced core of galvanised steel wire. |
| CORK LINE | Old term for head rope. |
| CREASING | Increasing the number of meshes in successive rows by cutting or by braiding. Antonym for bating. |
| DANLENO ASSEMBLY | Consisting of iron bobbin, swivelled on one end to the butterfly and the other end to the bridle on each side to achieve the horizontal spread of the net. |
| DENIER | A unit for meausring the linear density of yarns equal to the weight in grams per 900 m length. |
| DEPTH OF PANEL | Width of the net expressed in number of meshes running vertically or in number of rows. |

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|---|---|
| DOUBLE MESH | Meshes made of double twines usually used at junctions of the net and also for the cod ends where excess strain is experienced. |
| ELASTICITY | Property of a material with which it returns to its original dimension and shape on release of deforming force. |
| ELONGATION | The extension in the direction of load caused by a tensile force and is expressed as a percentage of the original legth of the material. |
| EXTRA BUOYANCY | See buoyancy |
| EYE SPLICE | A small loop spliced at the end of rope and reinforced with metallic "thimble" |
| FALSE BELLY | Strip of webbing attached to the underside the lower belly to prevent the net from tearing due to friction on the rough sea bed. |
| FIBRE | Basic material used for manufacturing yarns. May be of animal vegetative or synthetic origin. |

**FISHING GEAR**

Common term for the tool or tackle employed for catching fish either from a craft or from the shore of a water mass. Based on the mode of operation the gear may be active like trawl or purse-seines or may be passive like stake nets, set nets and traps. Based on its action on fish, the gear may be entangling (gill nets), engulfing (trawl) and angling(hooks) or stupifying (electrical gears) or wounding (spears, spikes, etc.). Based on the material used for its construction, the gear may be webbed or non-webbed.

**FLAPPER**

A small piece of webbing shaped to fit in the interior of the trawl and hung from the upper belly intended to prevent the escape of fish from codend to trawl mouth. SYN Funnel.

**FIGURE - EIGHT - LINK**

A metal link shaped like a figure eight and designed to join the kelly's eye.

**FOOT ROPE**

A synthetic or steel rope lining the lower bosom and lower wings with sinkers or chain pieces attached to it in order to add negative buoyancy to the lower panel of the net. SYN. Foot line, lead line, ground rope.

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|---|---|
| FLY MESH | Free hanging meshes having only two knots usually made at the edges of webbing for hanging the webbing. Also known as "Dog ear". |
| FLOAT | Materials having extra buoyancy like cork, wood, alluminium, plastic etc. attached to the head rope of nets to keep the upper portion of the net floating. Accounts for vertical opening of the trawl mouth. |
| 'G' LINK ASSEMBLY | A special clip link with a counter link shaped exactly to slide in, used for locking in of otter boards to the sweepline. |
| GALLOWS | Strong inverted 'V' shaped points on the aft of the trawler one on each board from which the gear is towed. |
| GROUND ROPE | See foot rope. Sometimes an additional rope with rubber rollers and metallic bobbins attached to the foot rope by means of links to save the gear in rocky and corally grounds. |
| HANGING THE NET | The process of attaching the webbing to the supporting or surrounding ropes. Done as per specific hanging co-efficient for each type of gear and also for different parts of the same gear. |
| HANGING CO-EFFICIENT | To ratio between the stretched length of the webbing and the total length of the rope on which the webbing is hung. Owing to the flexibility to the geometry of the webbing, the hanging co-efficient has two complementing components - the horizontal and vertical hanging coefficients. |

HEAD LINE ELEVATOR — A buoyant plate fitted with floats attached to the head rope for increasing the vertical opening of trawl net.

HEAD ROPE — A synthetic or steel rope lining the periphery of the upper bosom and upper wings to which floats are attached to gain extra buoyancy for the upper panel of trawl net.
SYN: Head line, cork line; float line

HEMP: — A plant the bast of which serves as a source for hemp fibre, widely used in the olden days for making twine and ropes.

JIB — Trianguler piece of webbing attached to both sides of upper and lower edges of the mouth portion of the trawl net.
SYN. Wedge

JUTE — A plant widely cultivated in India and Pakistan, a source of vegetable fibre.

KELLY'S EYE — Shackled to the double end of the backstrope. It is a combination of two metal rings, one for a shackle and the other for joining the figure-of-eight link.

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|---|---|
| KAPRON | A synthetic polyamide fibre used in fishing industry. |
| KNOT | A tie made by two ends of a twine or a rope etc. to join the ends or a tie made by one end at some part of its own body to make a lpop or over some other object to get it fasten to it. |
| KITE | See Danleno assembly |
| LACING | Seaming or joining the upper and lower halves of a trawl net alongtthe sides by winding a twine around a few meshes gathered from the edge of each half and fastening at intervals with a jam hitch or stop hitch. |
| LINE | A rope usually of a prescribed length for a well defined use. |
| LINEN | Yarns made from flax |
| MANILA | Hard fibre taken from the leaf stem of Abaca plant widely used as twines and ropes in fishing industry. |
| MENDING THE NET | Repairing the damages in the net |
| MESH | Inter-spaces of a fixed dimension formed by a sequence of knots. |
| MESH SIZE | Measured variously as bar length and stretched length, the former being the distance between two successive knots and the latter being the total stretched length between the mid points of the two farthest knots (Mesh size stretched) |

| | |
|---|---|
| MONOFILAMENT | A single continuous filament of same synthetic fibres. |
| MULTIFILAMENT | A filament yarn having several numbers of individual filaments. |
| NATURAL FIBRE | See fibre |
| NEEDLE, MENDING | Wooden or metallic tool used in braiding and mending nets |
| NET | A fishing gear of definite design made from webbing |
| NET, KNOTLESS | Webbing made on power looms by interweaving two twines at junction without making knots. |
| NYLON | A synthetic fibre belonging to polyamide group |
| OTTER BOARD | Large wooden or steel board mostly rectangular or oval in shape rigged to the trawl nets. By virtue of its calculated angle of attack to the sweep lines and the warp it diverges sideways and gives required horizontal spread to the trawl mouth. SYN - Otter door, trawl door. |

| | |
|---|---|
| OTTER TRAWL | Modern trawl gear rigged with otter boards. A name coined earlier to differentiate from the beam trawl. |
| PLY | No.of yarns in a strand or total No. of yarns in a twine. 20/4/3 means twine consisting of 3 strands and each strand consisting of 4 yarns (plys) of 20 counts. |
| POINT | A knot with one or two legs along the edge of a webbing (See Fig. ) |
| PRESERVATION OF NET | Treating the webbing with specific chemical solutions to prevent (1) slippage of knots (2) decay of vegetable fibres and (3) reaction of sun beams (in case of synthetic fibres) |
| QUARTER ROPE | Ropes attached to the trawl net for hauling the net. |
| REDUCING MESHES | See baiting |
| REEF KNOT | Common type of knot used in net making. SYN: Square knot or flat knot. |
| REEL | 1) The equipment on which yarn is wound 2) Used for hauling hook and line gear. |
| RIGGING THE NET | See assembling the net |

| | |
|---|---|
| ROTTING | Deterioration of strength of the net due to the action of moulds and bacteria in water. High water temperature quickens the rotting. |
| SEAM | Laced edge of net |
| SEAM LINE | Line laced along the seam |
| SELVEDGE | The two sides of the netting (lengthwise) SYN. SELVAGE |
| SETTING KNOT | Fastening the knots of webbing by treating with steam or by adhesive preservation |
| SILK | An animal fibre produced from pupa of silk worm |
| SISAL | Fibre obtained from leaf of the sisal plant |
| SIZE OF MESH | See mesh size |
| SLING | Splitting rope used in hauling the catch |
| SPLICING | Joining two ends of yarn, twine or rope by interweaving of its strands. |
| SPREADER | Short wooden or iron piece attached to the wing tip of trawl net to keep the wings vertically stretched. |
| SQUARE | Front portion on the upper panel of the net between head rope and belly which overhangs the lower portion of the trawl net. It prevents fish from swimming upwards from the trawl mouth. SYN. Overhang. |
| STRAND | An assembly of a number of yarns kept together by twisting them about its axis. Strands are twisted together to form the twine. |

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|---|---|
| STRETCHED MESH | See mesh stretched |
| SWEEP LINE | Wire rope which connects the trawl wing to otter board. It sweeps along the sea bottom and hence the name. |
| SYNTHETIC FIBRE | See fibre |
| STROP | A length of wire rope with the ends short spliced. |
| TAKE UP RATIO | The ratio between the stretched length of webbing to the length after hanging. |
| TENACITY | Breaking force in terms of the fibre or yarn denier expressed in gms per denier |
| TENSILE STRENGTH | Breaking force in terms of unit area expected in gms per square mm. |
| TERYLENE | A synthetic fibre belonging to the polyester fibre group. |
| THREAD | Strand or strands of yarn twisted into a fine line of twine. |
| TICKLER CHAIN | Iron chain attached ahead of the foot rope of a trawl to frighten the bottom fish and to induce them to enter the net. |
| TOWING CABLE | Long wire rope by which the vessel drags the net along the ocean floor. |
| TRAWL NET | Complete net with all sections joined together having a bag shape and dragged by a vessel. |
| TWINE | An aggregate of fibre or yarns twisted. |
| TWIST | Turns about the axis of fibre, yarn or |

twine to keep them together. Described as soft medium or hard twisted according to the twist per unit length.

**TRAWL WINCH** The mechanism for paying out and heaving the net and its accessories.

**WARP** The line by which the vessel tows or drags the trawl net.syn. towing cable, towing rope.

**WEBBING** A sheet of netting used for fabricating fishing nets

**WEDGE** See jib

**WINGS** The two end sections of the trawl net with a broad base and tapering to the ends (See Fig. 1).

**VERTICAL OPENING** The distance between the mid points of the upper and lower bosoms of a trawl net while in operation. Achieved by adding floats along the head rope and sinker along the foot rope.

**YARN** A numoer of fibres of filaments twisted together around a single axis to form a continuous line.

**YARN COUNT** Unit of expressing linear density of yarns.

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APPENDIX 1

## COST PARTICULARS OF 12 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | Cotton twine (20 x 15 x 3) | 27 kgs | Rs.25/kg | 675.00 |
| ROPES AND LINES | | | | |
| Head rope | 14 mm diameter combination (Manila & wire) rope | 17 m | Rs.4/m | 68.00 |
| Foot rope | 14 mm diameter combination (Manila & wire) rope | 19 m | Rs.4/m | 76.00 |
| Bolch line Belly line | 5 mm diameter nylon rope | 4.5 kgs | Rs.23/kg | 103.50 |
| OTHER ACCESSORIES | | | | |
| Floats | 150 mm diameter aluminium | 1 | Rs.12/each | 12.00 |
| | 130 mm diameter aluminium | 16 | Rs.12/each | 192.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 20 kgs | Rs.6/kg | 120.00 |
| Total cost of material | | | Rs. | 1246.50 |

### B. COST OF LABOUR

350 man hours at the rate of Rs.1.25 per hour — Rs.437.50

TOTAL COST Rs. 1,684/-

Say Rs. 1,700/-

## COST PARTICULARS OF 14 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs |
|---|---|---|---|---|
| WEBBING | 2.2 mm diameter cotton twine | 30 kgs | Rs.28/kg | 840.00 |
| ROPES AND LINES | | | | |
| Head rope | 14 mm diameter combination(Manila & wire)rope | 19 m | Rs.4/m | 76.00 |
| Foot rope | 14 mm diameter combination(Manila & wire) rope | 23 m | Rs.4/m | 92.00 |
| Bolch line & Belly line | 6 mm diameter nylon or polyethylene rope | 5 kgs | Rs.23/kg | 115.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 200 mm diameter aluminium | 1 | Rs.15/each | 15.00 |
| | 150 mm diameter aluminium | 16 | Rs.12/each | 192.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 24 kg | Rs.6/kg | 144.00 |
| Total cost of material | | | | Rs. 1474.00 |

### B. COST OF LABOUR

400 man hours at the rate of Rs.1.25 per hour — Rs. 500.00

TOTAL COST Rs. 1974.00
Say Rs. 2,000/-

## COST PARTICULARS OF 15 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2.5 mm diameter cotton or manila twine | 32 kg | Rs.25/kg | 800.00 |
| ROPES AND LINES | | | | |
| Head rope | 20 mm diameter combination (Manila & wire) rope | 20 m | Rs.4/m | 80.00 |
| Foot rope | 20 mm diameter combination (Manila & wire) rope | 24 m | Rs.4/m | 72.00 |
| Selch line & Belly line | 8 mm diameter nylon rope | 5 kg | Rs.23/kg | 115.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 250 mm diameter aluminimum | 1 | Rs.20/each | 20.00 |
| | 200 mm diameter aluminium | 18 | Rs.15/each | 270.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 37kg | Rs.6/kg | 222.00 |
| Total cost of material | | | | Rs.1579.00 |

### B. COST OF LABOUR

600 man hours at the rate of Rs.1.25 per hour — Rs. 750.00

TOTAL COST Rs.2329.00

Say : Rs.2400/-

APPENDIX 4

## COST PARTICULARS OF 16.5 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2.5 mm diameter cotton or manila twine | 35 kg | Rs.25/kg | 875.00 |
| ROPES AND LINES | | | | |
| Head rope | 20 mm diameter combination (Manila & wire) rope | 22 m | Rs.4/m | 88.00 |
| Foot rope | 20 mm diameter combination (Manila & wire) rope | 26 m | Rs.4/m | 104.00 |
| Bolch line & Belly line | 8 mm diameter nylon rope | 6 kg | Rs.23/kg | 138.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 250 mm diameter aluminium | 1 | Rs.20/each | 20.00 |
| | 200 mm diameter aluminium | 20 | Rs.15/each | 300.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 40 kg | Rs.6/kg | 240.00 |
| Total cost of material | | | | Rs. 1765.00 |

### B. COST OF LABOUR

650 man hours at the rate of Rs.1.25 per hour — Rs. 812.50/-

TOTAL COST Rs.2577.50

Say Rs.2600/-

## COST PARTICULARS OF 20 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2 mm diameter polypropylene or polyethylene twine | 35 kg | Rs.32/kg | 1120.00 |
| ROPES AND LINES | | | | |
| Head rope | 9 mm diameter galvanised steel wire rope | 22 m | Rs.5.5/m | 121.00 |
| Foot rope | 9 mm diameter galvanised steel wire rope | 33 m | Rs.5.5/m | 181.50 |
| Bolch line | 8 mm diameter nylon or polyethylene rope | 2 ½ kg | Rs.23/kg | 57.50 |
| Belly line | 8 mm diameter nylon or polyethylene rope | 2½kg | Rs.23/kg | 57.50 |
| OTHER ACCESSORIES | | | | |
| Floats | 200 mm diameter plastic | 12 nos | Rs.25/each | 300.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 35 kg | Rs.6/kg | 210.00 |
| Total cost of material | | | | Rs. 2047.50 |

### B. COST OF LABOUR

400 man hours at the rate of Rs.1.25 per hour — Rs.500.00

TOTAL COST Rs. 2547.50

Say Rs. 2600/-

## COST PARTICULARS OF 24 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2 mm diameter polypropylene or polyethylene twine | 40 kg | Rs.32/kg | 1280.00 |
| ROPES AND LINES | | | | |
| Head rope | 11 mm diameter galvanised steel wire rope | 29 m | Rs.6.25/m | 181.25 |
| Foot rope | 11 mm diameter galvanised steel wire rope | 33 m | Rs.6.25/m | 206.25 |
| Bolch line | 8 mm diameter nylon or polyethylene rope | 3 kg | Rs.23/kg | 69.00 |
| Belly line | 8 mm diameter nylon or polyethylene rope | 3 kg | Rs.23/kg | 69.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 250 mm diameter aluminium | 1 No. | Rs.20/each | 20.00 |
| | 200 mm diameter aluminium | 11 Nos. | Rs.15/each | 165.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 50 kg | Rs.6/kg | 300.00 |
| Total cost of material | | | | Rs.2290.50 |

### B. COST OF LABOUR

560 man hours at the rate of Rs.1.25 per hour — Rs. 700.00

TOTAL COST Rs.2990.50

Say Rs.3000/-

| | | | | |
|---|---|---|---|---|
| WEBBING | 2 mm diameter polypropylene or polyethylene twine | 40 kg | Rs.32/Kg. | 1280.00 |

TOTAL COST Rs.2990.50

APPENDIX 7

## COST PARTICULARS OF 24 M MODIFIED TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2 mm diameter polypropylene or polyethylene twine | 40 kg | Rs.32/kg | 1280.00 |
| ROPES AND LINES | | | | |
| Head rope | 11 mm diameter galvanised steel wire rope | 29 m | Rs.6.25/m | 181.25 |
| Foot rope | 11 mm diameter galvanised steel wire rope | 37 m | Rs.6.25/m | 231.25 |
| Bolch line | 8 mm diameter nylon or polyethylene rope | 3 kg | Rs.23/kg | 69.00 |
| Belly line | 8 mm diameter nylon or polyethylene rope | 3 kg | Rs.23/kg | 69.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 250 mm diameter aluminium | 1 No. | Rs.20/each | 20.00 |
| | 200 mm diameter aluminium | 15 Nos. | Rs.15/each | 225.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 55 kg | Rs.6/kg | 330.00 |
| Total cost of material | | | | Rs.2405.50 |

### B. COST OF LABOUR

575 man hours at the rate of Rs.1.25 per hour — Rs. 718.75

TOTAL COST — Rs. 3124.25

Say — Rs.3200/-

## COST PARTICULARS OF 30 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2 mm diameter polypropylene or polyethelene | 40 kgs | Rs.32/kg | 1280.00 |
| | 2.5 mm diameter polypropylene or polyethelene twine | 10 kgs | Rs.32/kg | 320.00 |
| ROPES AND LINES | | | | |
| Head rope | 11 mm diameter galvanised steel wire rope | 35 m | Rs.6.25/m | 218.75 |
| Foot rope | 11 mm diameter galvanised steel wire rope | 39 m | Rs.6.25/m | 243.75 |
| Bolch line & Belly line | 8 mm diameter nylon or polyethelene rope | 8 kg | Rs.23/kg | 184.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 250 mm diameter aluminium | 1 No. | Rs.20/each | 20.00 |
| | 200 mm diameter aluminium | 16 Nos. | Rs.15/each | 240.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 55 kgs | Rs.6/kg | 330.00 |
| Total cost of material | | | | Rs.2836.50 |

### B. COST OF LABOUR

800 man hours at the rate of Rs.1.25 per hour — Rs.1000.00

T O T A L C O S T Rs. 3836.50

Say Rs. 3900/-

## COST PARTICULARS OF 35 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2.5 mm diameter polypropylene or polyethylene rope | 80 kg | Rs.32/kg | 2560.00 |
| ROPES AND LINES | | | | |
| Head rope | 11 mm diameter galvanised steel wire rope | 39 m | Rs.6.25/m | 243.75 |
| Foot rope | 11 mm diameter galvanised steel wire rope | 45 m | Rs.6.25/m | 281.25 |
| Bolch line & Belly line | 8 mm diameter nylon rope | 6 kg | Rs.23 | 138.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 200 mm diameter plastic | 18 Nos. | Rs.25/each. | 450.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 60 kg | Rs.6/kg | 360.00 |
| Total cost of material | | | | Rs. 4033.00 |

### B. COST OF LABOUR

950 man hours at the rate of Rs.1.25 per hour — Rs. 1187.50

TOTAL COST Rs. 5220.50

Say Rs. 5300/-

APPENDIX 10

## COST PARTICULARS OF 45 M TWO SEAM FISH TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 2.5 mm diameter polypropylene or polyethylene twine | 110 kg | Rs.32/kg | 3520.00 |
| ROPES AND LINES | | | | |
| Head rope | 11 mm diameter galvanised steel wire rope | 50 m | Rs.6.25/m | 312.50 |
| Foot rope | 11 mm diameter galvanised steel wire rope | 59 m | Rs.6.25/m | 368.75 |
| Bolch line | 8 mm diameter nylon or polyethylene rope | 8 kg | Rs.32/kg | 184.00 |
| Belly line | 8 mm diameter nylon or polyethylene rope | 6 kg | Rs.23/kg | 138.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 200 mm diameter aluminium | 20 Nos | Rs.15/each | 300.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 75 kg | Rs. 6/kg | 450.00 |
| Total cost of material | | | | Rs. 5273.25 |

### B. COST OF LABOUR

100 man hours at the rate of Rs.1.25 per hour — Rs. 1250.00

TOTAL COST Rs. 6523.25

Say Rs. 6600/-

APPENDIX 11

## COST PARTICULARS OF 17 M FOUR SEAM SHRIMP TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | Cotton twine (20 x 8 x 3, 20 x 10 x 3, 20 x 15 x 3 and 20 x 20 x 3) | 35 kg | Rs.28/kg | 980.00 |
| ROPES AND LINES | | | | |
| Head rope | 16 mm and 24 mm diameter manila rope | 20 m | Rs.4/m | 80.00 |
| Foot rope | 16 mm and 24 mm diameter manila rope | 20 m | Rs.4/m | 80.00 |
| Bolch line & Belly line | 5 mm diameter cotton rope | 2 kgs | Rs.15/kg | 30.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 127 mm diameter aluminium | 17 Nos. | Rs.15/each | 255.00 |
| Sinkers | Lead weight | 22 kgs | Rs.10/kg | 220.00 |
| Total cost of material | | | | Rs.1645.00 |

### B. COST OF LABOUR

640 man hours at the rate of Rs.1.25 per hour — Rs. 800.00

TOTAL COST Rs. 2445.00

Say Rs. 2500/-

## COST PARTICULARS OF 18 M FOUR SEAM SHRIMP TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | Cotton twine (20 x 8 x 3, 20 x 10, x 3, 20 x 15 x 3, and 20 x 20 x 3). | 38 kg | Rs.28/kg | 1064.00 |
| ROPES AND LINES | | | | |
| Head rope | 16 mm and 24 mm diameter manila rope | 21 m | Rs. 4/m | 84.00 |
| Foot rope | 16 mm and 24 mm diameter manila rope | 21 m | Rs. 4/m | 84.00 |
| Bolch line & Belly line | 5 mm diameter cotton rope | 2 kgs | Rs.15/kg | 30.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 127 mm diameter aluminium | 19 Nos. | Rs.15/each | 285.00 |
| Sinkers | Lead weight | 25 kg | Rs.10/kg | 250.00 |
| Total cost of material | | | | Rs.1797.00 |

### B. COST OF LABOUR

660 man hours at the rate of Rs.1.25/hour — Rs.825.00

TOTAL COST Rs.2622.00

Say Rs.2700/-

## COST PARTICULARS OF 27 M FOUR SEAM SHRIMP TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 1.5 mm polypropylene or polyethylene twine | 40 kg | Rs. 32/kg | 1280.00 |
| | 2.5 mm polypropylene or polyethylene twine | 10 kg | Rs. 32/kg | 320.00 |
| ROPES AND LINES | | | | |
| Head rope | 9 mm diameter galvanised steel wire rope | 29 m | Rs. 5.50/m | 159.50 |
| Foot rope | 9 mm diameter galvanised steel wire rope | 29 m | Rs. 5.50/m | 159.50 |
| Bolch line | 3 mm diameter polyethylene rope | 1.5 kg | Rs. 23/kg | 34.50 |
| Belly line | 6 mm diameter polyethylene or polypropylene rope | 1.5 kg | Rs 23/kg | 103.50 |
| OTHER ACCESSORIES | | | | |
| Floats | 200 mm diameter plastic | 9 Nos. | Rs. 25/each | 225.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 35 kg | Rs. 6/kg | 210.00 |
| Total cost of material | | | | Rs. 1852.00 |

### B. COST OF LABOUR

| | |
|---|---|
| 1550 man hours at the rate of Rs. 1.25 per hour | Rs. 1937.5 |
| | Rs. 3789.50 |
| | Say Rs. 3800/- |

## COST PARTICULARS OF 28 M FOUR SEAM SHRIMP TRAWL

### A. COST OF MATERIAL

| Items | Specifications | Quantity | Rate/unit | Cost Rs. |
|---|---|---|---|---|
| WEBBING | 1.5 mm diameter polypropylene or polyethylene twine | 38 kgs | Rs.32/kg | 1216.00 |
| | 2.5 mm diameter polypropylene or polyethylene twine | 12 kgs | Rs.32/kg | 384.00 |
| ROPES AND LINES | | | | |
| Head rope | 9 mm diameter galvanised steel wire rope | 31 m | Rs.5.5/m | 170.50 |
| Foot rope | 9 mm diameter galvanised steel wire rope | 35 m | Rs.5.5/m | 192.50 |
| Bolch line | 6 mm diameter polyethylene rope | 4.5 kg | Rs.23/kg | 103.50 |
| Belly line | 10 mm diameter polyethylene rope | 5 kg | Rs.23/kg | 115.00 |
| OTHER ACCESSORIES | | | | |
| Floats | 200 mm diameter plastic | 12 Nos. | Rs.25/each | 300.00 |
| Sinkers | 9 mm diameter galvanised iron chain | 50 kg | Rs.6/kg | 300.00 |
| Total cost of material | | | | Rs.2781.50 |

### B. COST OF LABOUR

1600 man hours at the rate of Rs.1.25 per hour — Rs.2000.00

TOTAL COST Rs.4781.50

Say Rs.4800/-

# Common Cutting Rates and Taper Ratios

Number of meshes lost or gained)

Number of meshes in depth

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AB | 1T2B | 1T1B | 3T2B | 2T1B | 5T2B | 3T1B | 7T2B | 4T1B | 9T2B |
| 2 | 1N2B | AB | 1T4B | 1T2B | 3T4B | 1T1B | 5T4B | 3T2B | 7T4B | 2T1B |
| 3 | 1N1B | 1N4B | AB | 1T6B | 1T3B | 1T2B | 2T3B | 6T6B | 1T1B | 7T6B |
| 4 | 3N2B | 1N2B | 1N6B | AB | 1T8B | 1T4B | 3T8B | 1T2B | 5T8B | 3T4B |
| 5 | 2N1B | 3N4B | 1N3B | 1N8B | AB | 1T10B | 1T5B | 3T10B | 2T5B | 1T2B |
| 6 | 5N2B | 1N1B | 1N2B | 1N4B | 1N10B | AB | 1T12B | 1T6B | 1T4B | 1T3B |
| 7 | 3N1B | 5N4B | 2N3B | 3N8B | 1N5B | 1N12B | AB | 1T14B | 1T7B | 3T14B |
| 8 | 7N2B | 3N2B | 5N10B | 1N2B | 3N10B | 1N6B | 1N14B | AB | 1T16B | 1T8B |
| 9 | 4N1B | 7N4B | 1N1B | 5N8B | 2N5B | 1N4B | 1N7B | 1N16B | AB | 1T18B |
| 10 | 9N2B | 2N1B | 7N6B | 3N4B | 1N2B | 1N3B | 3N14B | 1N8B | 1N18B | AB |
| 11 | 5N1B | 9N4B | 4N3B | 7N8B | 3N5B | 5N12B | 2N7B | 3N16B | 1N9B | 1N20B |
| 12 | 11N2B | 5N2B | 3N2B | 1N1B | 7N10B | 1N2B | 5N14B | 1N4B | 1N6B | 1N10B |
| 13 | 6N1B | 11N4B | 5N3B | 9N8B | 4N5B | 7N12B | 3N7B | 5N16B | 2N9B | 3N20B |
| 14 | 13N2B | 3N1B | 11N6B | 5N4B | 9N10B | 2N3B | 1N2B | 3N6B | 5N18B | 1N5B |
| 15 | 7N1B | 13N4B | 2N1B | 11N8B | 1N1B | 3N4B | 4N7B | 7N16B | 1N3B | 1N4B |
| 16 | 15N2B | 7N2B | 13N6B | 3N2B | 11N10B | 5N6B | 9N14B | 1N2B | 7N18B | 3N10B |
| 17 | 8N1B | 15N4B | 7N3B | 13N8B | 3N3B | 11N12B | 5N7B | 9N16B | 4N9B | 7N20B |
| 18 | 17N2B | 4N1B | 5N2B | 7N4B | 13N10B | 1N1B | 11N14B | 5N8B | 1N2B | 2N5B |
| 19 | 9N1B | 17N4B | 8N3B | 15N8B | 7N6B | 13N12B | 6N7B | 11N16B | 5N9B | 9N20B |

COURTESY : F A O CATALOGUE OF FISHING GEAR DESIGN—1972

A..... ALL

B..... BAR CUT

T..... TRANSVERSCUT (mesh)

N..... NORMAL CUT (point)